THE GAS JOURNAL

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A Glance at the Contents—

Theory and Practice on the District.

In a paper before the Midland Junior Gas Association, Mr. G. H. Davies, of Hereford, emphasized the importance of a well-organized distribution department. [p. 198.]

Gas-Works Bye-Products in Australia.

Speaking before the Seventh Convention of the Australian Gas Institute, held at Melbourne, Mr. R. S. Andrews, B.Sc., reviewed the position of gas-works bye-products in Australia. [p. 206.]

Controlled Cracking in Continuous Verticals.

Mr. E. B. Tomlinson, Engineer-in-Chief of the Birmingham Gas Department, indicates the present position of the Department's work on controlled cracking in continuous vertical retorts and summarizes the phases through which the investigation has passed. [p. 195.]

Lighting of the Tower Bridge.

From photographs which accompany an article on the modernized gas lighting of Tower Bridge, London, readers will gain an idea of the success of the new installation. [p. 197.]

Assessment of Combustible Nature of Coke.

In a paper before the Institute of Fuel, Messrs. H. E. Blayden, W. Noble, and H. L. Riley outlined a simple laboratory method for the assessment of the combustible nature of coke. [p. 201.]

The Education of the Gas Manager.

In an address to the Scottish Junior Gas Association, at a joint meeting at Glasgow, Colonel W. M. Carr, of Stretford, discussed the education, training, and development of the gas engineer and manager. [p. 199.]

Forthcoming Engagements

Jan. 26.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. W. E. Benton.

Jan. 27.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION.—Meeting. Paper by Mr. F. Robertson.

Jan. 30.—I.G.E.—Meeting of General Research Committee, 2.30 p.m.

Jan. 31.—INSTITUTION OF CHEMICAL ENGINEERS.—Meeting. Papers by Mr. H. Hollings and Mr. L. Silver on "Washing of Gas."

Feb. 1.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Paper by Mr. E. L. Wallis.

Feb. 5.—MIDLAND ASSOCIATION.—Annual Dinner and Dance, Grand Hotel, Birmingham. Reception, 6 p.m.; Dinner, 6.30 p.m.

Feb. 5.—INSTITUTION OF CHEMICAL ENGINEERS.—Meeting of Chemical Engineering Group. Paper by Messrs. H. Hollings and S. Hay on "Recovery of Benzole by Activated Carbon."

Feb. 10.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Visit to Chester. Paper by Mr. H. G. Davison.

Feb. 12.—I.G.E.—Meetings of Finance Sub-Committee, 1.45 p.m.; Membership Sub-Committee, 2.30 p.m.; General Purposes Committee, 3.15 p.m.

Feb. 13.—I.G.E.—Meetings of Council, 10 a.m.; Gas Education Executive Committee, 4 p.m.

Feb. 16.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. P. Lloyd.

Feb. 17.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Shipley. Paper by Mr. L. R. Cowley.

Feb. 17.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Visit to Portobello Power Station. Paper by Mr. W. Masterton.

Feb. 21.—B.C.G.A.—Meeting of Executive Committee, 12 noon, 28, Grosvenor Gardens, S.W. 1.

Feb. 22.—B.I.F.—Visit of Joint Junior Gas Associations.

Feb. 23.—B.I.F.—Gas Salesmen's Day.

Feb. 24.—WESTERN JUNIOR ASSOCIATION.—Meeting at Bristol. Paper by Mr. C. H. Chester.

Feb. 27-March 1.—B.I.F.—Joint Gas Conference.

March 8.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Paper by Mr. H. J. Reynolds.

March 10.—WESTERN JUNIOR ASSOCIATION.—Meeting at Plymouth. Paper by Mr. A. R. Langford.

March 14.—I.G.E.—Meeting of Meters Committee, 2.30 p.m.

March 16.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. L. T. Minchin.

April 6.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. H. H. Brown.

1934 "JOURNAL" Directory.

Page 2. ABERTILLERY. H. Maycock appointed E. & M., vice I. G. Jenkins, resigned.

Page 46. MIDDLETON. H. D. Robinson appointed E. & M., vice W. Rogerson, resigned.

Page 86. LANARK C.C. (Cambuslang). E. R. Mitchell appointed Superintendent.

Page 88.—LOCHGELLY. A. Nisbet, E. & S., deceased.

Page 92. TAYPORT. F. R. Mitchell, E., M., & S., resigned.

Page 117.—B.C.G.A. W. D. Rowe appointed Manager.

EDITORIAL NOTES

Controlled Cracking

THE extent to which dilution of coal gas can be carried out when making gas of a given declared calorific value depends upon the calorific value of the straight coal gas made. It is therefore obvious that where dilution of straight coal gas with blue water gas is found profitable, the aim should be towards high calorific value of the coal gas in addition to high thermal yield per ton. This was emphasized by Mr. S. K. Hawthorn in his Presidential Address to the Midland Junior Gas Association last October—see "JOURNAL" for Oct. 18, 1933. He expressed the view that the make of therms of the enriching hydrocarbons, and their calorific value, are the true index to gas-making efficiency, and that in this direction lie possibilities of improvement. A high thermal yield of hydrocarbons in coal gas depends upon correct heat treatment of the tarry vapours, it being necessary to maintain a balance between "over-cracking" and "under-cracking;" and what is needed is more control of the vapours evolved during carbonization. Mr. Hawthorn indicated that this would be particularly beneficial in connection with continuous vertical retorts.

This idea is by no means new, but in the commercial application of the principle of continuous carbonization in vertical retorts complications in process have naturally had to take second place to the development of a reliable apparatus. In 1932 Mr. Hawthorn, however, re-introduced the subject to Mr. Tomlinson, Engineer-in-Chief to the Birmingham Gas Department, and designed a coal feed whereby the charge of coal could be kept at any predetermined depth below the top of the brickwork, the coal being fed mechanically on to the top of the charge in small quantities and very frequently. The Department decided to make a full investigation of the matter, and experimental work was commenced in July of 1932 under the direction of Mr. Rhead, the Chief Chemist. The work was carried out on Woodall-Duckham retorts, and the Woodall-Duckham Company co-operated. In our issue to-day Mr. Tomlinson gives an account of the work and the results, and this will be of great value to the Gas Industry. It has been found that a coal which, on a throughput of 6·1 tons per day, yielded 81·6 therms of 477 B.Th.U. gas under normal conditions (12·3% steaming), yielded 84·8 therms of 528 B.Th.U. gas under conditions of controlled cracking (14·5% steaming), the throughput being 5·2 tons a day.

Calculating on a basis of 475 B.Th.U. gas in each case (by the addition of blue water gas of 300 B.Th.U. per c.ft.) the therms per ton are 99·4 and 82·3 respectively. This clearly indicates the possibility of improving the yield of straight coal gas on continuous vertical retorts; and similar results have been obtained from various types of gas coal. Under controlled cracking conditions the coke made had a greater bulk density than that produced in normal practice, and the tar was modified, showing many characteristics of horizontal tar.

Having established the technical possibilities of controlled cracking it was decided to continue the investigation eliminating the separately controlled coal feed, and, by introducing a deep feed pipe, to allow once again the rate of coke extraction automatically to govern the rate of coal feed. This pipe feed method is now being tried out on a range of continuous vertical retorts having a carbonizing capacity of 100 tons of coal a day. Mr. Tomlinson concludes his most interesting article by saying that it is hoped from these tests to judge the commercial aspect of the process. Particular attention is to be paid to coal throughput, calorific value and yield of gas, and quality and yield of coke, benzole, and tar. The results of this investigation should prove of great importance to the Industry.

Assessing Coke Values

A LABORATORY apparatus has been devised which should serve as a most useful guide to the combustibilities of cokes and hence assist in better marketing. It is not intended to supplant the test in the open firegrate. This test under practical conditions is, however, a lengthy one; a single test occupies a day. The laboratory apparatus, on the other hand, which has been designed in the laboratory of the Northern Coke Research Committee and is described by Messrs. Blayden, Noble, and Riley in the "JOURNAL" to-day, is able to cope with four tests a day and provide quantitatively an idea of the combustible nature of the cokes. The method is to determine the minimum air current in which the coke will continue to burn for more than twenty minutes after it has been lighted under standardized conditions. This value is termed by the authors the "critical air blast," and an idea of its range and significance will be gained from the table of results set out, which covers many types of coke.

Particularly interesting is the authors' account of experiments made on the properties of coke from various parts of an oven—experiments which clearly demonstrate the marked variation of the combustible properties of coke with its position in the oven during carbonization. It is suggested that the separation of coke from the oven into reactive and less reactive fractions has certain possibilities, for it would lead to the production, at the same plant, of coke more suitable for specific purposes than the normal coke—*e.g.*, the reactive fractions would provide good open fire and closed stove fuel, whereas the less reactive coke might prove more suitable for larger stoves and furnaces. In any case it is obvious from the work described that there is a decided need for the strict control of the combustible properties of coke, particularly if the coke is destined for the domestic market. In this connection we would draw attention to the results on the coke designated "special high-temperature oven coke (experimental)"—a fuel which "gave a very pleasant, bright fire in an open well grate over a period of fifteen hours." This coke had a critical air blast value of 0·042 c.ft. per minute; and the authors state that to obtain a satisfactory fire in an ordinary open well grate a coke with a critical air blast value of about 0·04 or less is necessary. It will be noted that one of the "gas cokes" had a value of 0·045, while another had a value of 0·073—a value so high that even its performance in a small domestic boiler was unsatisfactory. Naturally conditions of use vary widely and play an important part in the successful burning of coke, but—and taking the limitations of the method described into account—the apparatus of the Northern Coke Research Committee holds great promise, and it would be of advantage if equipment of the nature could be standardized and adopted by the different laboratories, for it appears that its use does not depend on the human element.

The Telephone and the Consumer

For several years prior to July, 1932, the Distribution Department of the Philadelphia Gas-Works Company operated from five separate and distinct points. Since then, however, centranzation and re-organization of the department has been undertaken, and the work is now divided into two parts. One part deals with all street work, and includes public lighting; while all the work inside customers' houses, such as fixing and removing meters, installing and servicing appliances, turning gas on and off, and despatching work orders, has been assigned to a newly-organized Customers' Service Division. This centralization has proved to be more economical than the old system, and by providing better controls has permitted the Company to render more efficient service to the public. Upon the completion of the centralization of the Distribution Department, steps were taken to bring about the centralization of certain activities of the Commercial Department—such as customers' accounting, merchandise accounting, billing, meter reading, and collections. This left in the District Offices only customer contact, receipt of money, and sales of merchandise.

When the method followed is to devote the first floors of the District Offices to receiving the public and the sale of appliances, and the other floors to accounting purposes, it is necessary to telephone to some other floor for information from records. Working on the premise that it takes no more time to telephone to a location elsewhere in the city than to telephone to another floor, provided an efficient telephone system could be developed, the main obstacle to centralization was removed. All that was necessary was to develop a telephone system which would assure instant service. Such a telephone system has been provided, and as we believe the installation is the second only of its kind in America, and the first to be adopted by a public utility, some attention is devoted to it here. As a matter of fact, the working of the system was seen, and created particular interest, during the Institution Tour of the United States last autumn, and the reference to the matter which appeared on p. 396 of the "Journal" for Nov. 8 led to further inquiries being made on this side.

As an example of the capacity of the system, it may be mentioned that, on Friday, Dec. 29, when outside temperatures were recorded in Philadelphia as low as 2° below zero, the Telephone Service Division received over 2700 calls, and on Saturday, Dec. 30, when outside temperatures were reported as low as 4° below zero, this influx of calls increased to about 4600. Calls for this period of the year normally average around 1500 per day. The maximum hour was between 9 a.m. and 10 a.m. on Dec. 30, when 678 calls were received. During this hour, 25 clerks were taking calls from customers, and facilities were such that each customer was given the same individual attention as if he were the only one requesting service. The new telephone equipment was severely taxed for the first time, and it stood the test without a flaw.

Philadelphia's Installation

In an account of the new telephone system which appears in the January issue of the *Philadelphia Gas-Works News*—the House Organ of the Gas Company—it is pointed out that it was realized that centralization, to be successful, would have to be built around a capable communicating system, providing a rapid and efficient means of obtaining and conveying information from records to contact clerks and giving of information to the public. It was decided that the telephone was the best medium to use, and the Bell Telephone Company of Pennsylvania were consulted.

Under the de-centralized plan, telephone switchboards were used in each of the various District Offices and District Shops. The public were instructed to call one of the numbers listed in the telephone directory servicing their particular geographical division of the city. Many customers would call the wrong number, and many would of necessity be transferred to one or more other locations in order to receive satisfactory answers to their requests. Both conditions required the customer to repeat his story to each switchboard attendant through which his call passed. For years this system proved to be a source of annoyance, and the new system was developed to eliminate this confusion.

The first major requirement in developing the communication system was to make possible the functioning, as a unit, of all the various activities of the Company in which the public are involved, and this was accomplished by installing a dial telephone system within the Company. This automatic dial telephone system, eliminating all but one manual switchboard, is the controlling feature which makes centralization a fact, and not a desirable theory. Telephone calls from the public are brought into this system over two groups of lines. When a customer now consults his telephone directory, he finds two numbers listed—one for service and one for administrative purposes. A customer's call over the service number is answered directly by a customer contact representative. This call passes through an automatic switch device, thereby eliminating the manual telephone operators. No repeating of the customer's story is necessary, and in only rare cases is any transfer required. Telephone contact representatives, or the contact clerks in the District Offices, may dial and get direct contact with an accounting zone, collection division, open order file, despatching clerk, &c., without going through a manual switchboard or being subjected to transfer.

Briefly, this system expedites the handling of telephone service calls from the public as follows: (1) A customer states his story but once. (2) The first voice the customer hears carries him all the way through to the successful completion of his inquiry. (3) A customer is given attention during every second of the transaction. There is no waiting, no transfer, no "hanging on" a silent line, wondering if he has been forgotten. (4) Any peculiar problem, irregularity, or error is corrected and handled by the first Gas Company employee answering the telephone. Never, in any circumstances, is a customer required to make additional calls, transferred, or asked to repeat his request to another employee, when such request is the usual type of service call.

Persons outside the Company who wish to speak to some officer or individual within the Company, are directed (in the city telephone directory) to call the number listed for administrative purposes. Such calls are answered by the usual telephone operators at a standard manual switchboard. These operators make the necessary connections to the individuals desired. Occasionally, a customer calls over the administrative line when he has a service request. The operator merely transfers the call to the service line, and it proceeds to the telephone contact representative as described above. Also, certain people call the service number when they wish to speak to individuals. The telephone contact representatives transfer such calls to the telephone operators, who make the desired connections in the usual way. Calls to be transferred in this way are rare, averaging but two or three per day.

Method of Operation

Now let us follow briefly the explanation given by the *Philadelphia Gas-Works News* of the working of this centralized telephone system—remarking first of all that, in order to secure the results required, it was naturally necessary to train a special group of employees to represent the Gas Company, so that any type of inquiry whatsoever might be answered satisfactorily by the first person receiving it. As to the installation itself, it may be said that the following functional divisions are connected with the dial system, permitting instant communication with each other through dial telephones:

Order Receiving Section.
Open Order Section.
Dispatching Desk.
Accounting Zones.
Merchandise Accounting Section.
All individual telephones.
Final Bill Zone.
Credit and Collection Division.
Billing Division.
Deposit Section.
All District Offices and Sales Floors.

After a customer's call has passed through an automatic switching and distributing device, it passes on to

the Order Receiving Section, where it is received and answered. In this section all calls for service are received from the public. The personnel is provided with the necessary forms for the origination of orders. The telephone equipment allows the telephone contact representatives to obtain information from records anywhere in the system without disconnecting the customer, who may be permitted, if it is desired, to carry on a three-way conversation.

The representatives are given the privilege of granting extensions for payment of bills and making certain other promises without consulting other divisions. Requests for such extensions and for duplicate bills are recorded, and notices of these and other promises sent to the proper divisions for execution. The entire system is planned with the idea of terminating at this point as many of the calls as possible. We learn that, when first started, the Company were able so to terminate about 70% of the calls; they are now, after three months of operation, terminating almost 90%.

Connected with the system there is an observation unit, depicting the flow of traffic. Hourly records are kept showing how many employees are required to man the equipment during the various hours of the day. There are thirty positions in this section of the system, but it has been unnecessary to man more than twenty-four of them at one time. The system is so flexible that it may be operated by any number, from two to thirty persons.

As orders are taken they are placed in a metal trough extending down the centre of the table, and through this runs a conveyor belt. On this belt the orders are carried to the Open Order Desk. At this point duplicates are detached from originals, and are kept in a specially designed file until the orders are completed. All "open" orders are available to any one or all six of the clerks, and information as to orders is therefore instantly available when answering customer inquiries. Originals of the orders are placed on another conveyor belt which carries them to the Dispatching Desk.

The arrangement of the Dispatching Desk allows one or up to six employees to dispatch orders without confusion, by means of a sliding tray in the centre of the table; the tray being sub-divided according to types of orders and geographical sub-divisions of the city. The six telephone units here are in multiple, so that any one or all of the dispatchers may talk at one time. Eight of the twelve lines coming in to this desk are for unlisted numbers, used exclusively by Customers' Service Division employees telephoning for orders or instructions. A dispatching desk, following the same principle but on a smaller scale, is used by the Street Division.

In the office of the Supervisor of the Telephone Service Division are located two observation boards, which allow the Supervisor to sample conversations all over the system, thereby making possible the gathering of data to be used for training purposes.

The success of this highly ingenious scheme evolved in the offices of the Philadelphia Gas-Works Company has been most marked. The speed and quality of the service has been improved, while operating costs have been reduced. The needs of customers are attended to with greater ease, directness, and dispatch than ever before in the history of the Company. Customers' orders and requests pass through fewer hands, follow a more simple and direct route in process of completion, require fewer forms, and involve less detail than ever before.

PERSONAL

NEW B.C.G.A. MANAGER.

At their meeting on Wednesday, Jan. 17, the General Committee of the British Commercial Gas Association appointed Mr. William D. Rowe to the position of Manager of the Association.

Mr. Rowe, who was born at Birkenhead in 1888, entered H.M. Civil Service in 1904, and at the outbreak of war was Assistant to the Educational Adviser to Indian Students in this country and Warden of their Hostel. He served in the Great War, was awarded the M.C. with Bar, was mentioned in Dispatches, and subsequently became a Staff Captain in the Regular Army, resigning voluntarily in 1923, when he entered the world of journalism and newspaper management. Later he became General Manager of the Head Office of Allied Newspapers, Ltd., Withy Grove, Manchester, where there are between 3000 and 4000 employees. He resigned not long ago owing to amalgamation changes, carrying high testimonials from the heads of the Company.

Mr. Rowe has already taken up duty at Grosvenor Gardens, where his assistance will be much welcomed by Sir Francis Goodenough, the over-worked Executive Chairman of the B.C.G.A.

We are sorry to hear that Mr. J. C. Walker, the popular General Secretary, is in a Nursing Home suffering from a renewal of the skin trouble which it was honed had been cured by his recent trip to Jamaica. Mr. Walker is, however, making good progress towards recovery, and all in the Industry will wish that this may not only be speedy but complete.

We are glad, as will be his many friends, to hear from Sir Francis that Lord Horder is well satisfied with his progress to full recovery from his recent attack, and that he received the permission of his medical adviser to attend the functions at Bath and Oxford this week connected with the gas undertakings of those cities.

* * *

At a special meeting of the Abertillery Urban Council on Monday, Jan. 15, Mr. H. Maycock, Assistant Engineer and Manager of the Sittingbourne and District Gas Company, was appointed Engineer and Manager of the Abertillery Gas Department in succession to Mr. I. G. Jenkins, who, as reported recently, has joined the staff of Messrs. R. & A. Main, Ltd. Mr. Maycock will take over his new duties early in February.

* * *

Mr. Frank G. Symon, Assistant Manager at Motherwell Gas-Works, has been appointed Assistant Engineer and Manager to the Coatbridge Gas Company in succession to Mr. Alexander Tran, who was recently appointed to the position of Chief Assistant Engineer and Manager of the Bath Gas Company.

* * *

Mr. Ifor G. Jenkins, Engineer and Manager of the Abertillery District Council's Gas Department, who has been connected with the undertaking for the past 22 years, on Thursday last was the recipient of a grandfather clock from the members of the Abertillery Urban District Council and the local branch of the National Association of Local Government Officers. The presentation was made jointly by Mr. J. T. Boots, "father" of the Council, and Mr. Frank Padfield, senior official.

* * *

Lanark County Council has appointed Mr. Fred R. Mitchell, Manager of the Tayport Gas-Works, Fife, to the position of Superintendent of the Cambuslang Works.

* * *

An engagement has been announced between Mildred Emma, only daughter of the late Mr. and Mrs. W. J. Carpenter, of Great Yarmouth, and Mr. W. C. Chapman, Engineer and Manager to the Boston Gas Light and Coke Company.

OBITUARY

The death took place on Jan. 13 at Lochgelly of Mr. Alexander Nisbet, Engineer and Secretary of the Lochgelly Gas Company, Ltd. Mr. Nisbet, who was 59 years of age and a native of Eauldhouse, had been resident in Lochgelly for 40 years. Shortly after the war, he entered public life and obtained a seat on the Lochgelly Town Council and Auchterderran Parish Council. Three years ago, he was elected to the Magistracy. It was only last November, owing to ill-health, that he was obliged to retire from public life. Deceased was an accomplished musician, and for a long period took a very active interest in Lochgelly Choral Union. He was also an elder and formerly treasurer of Macainsh church. In these and other ways, he served that town faithfully and well, and gained for himself the esteem of a wide circle of friends.

CORRESPONDENCE

British Cast Iron Research Association.

SIR,—I would like to take this opportunity of thanking Mr. Finlayson for his kind reference to the work of the above Association in his recent paper on maintenance costs, and you also for the editorial reference in the issue of the "JOURNAL" for Jan. 17. Your readers may be interested to know that this Association welcomes the support of all British users of cast-iron and foundry products. Such users, together with equipment manufacturers, form a special grade of membership, the subscription to which is five guineas per annum. In return for this the services of the Association are available for information and advice on technical matters connected with the use and application of cast and malleable iron. An excellent library and information bureau is available, and the quarterly Bulletin is regularly forwarded, containing abstracts of articles on foundry development from world-wide sources. The Association's research reports, mainly intended for manufacturers, are not circulated to user members unless released by the Council for general circulation. The importance of developments in this field during the past ten years can scarcely be overstressed, and I should be glad to send further details, together with a copy of the last Annual Report, to the engineers or managers of any gas undertakings interested.

Yours, &c.,
J. G. PEARCE,
Director.

British Cast Iron Research Association,
21-23, *St. Paul's Square,*
Birmingham, 3,
Jan. 22, 1934.

THE NEWS OF THE WEEK

The Directors of the Commercial Gas Company, at the annual general meeting on Feb. 8, will recommend a final dividend of 3¼% (less income-tax) on the ordinary stock of the Company, making, with the interim dividend of 2½% paid in August last, 5¾% for the year to Dec. 31, 1933. The dividend is the same as for the previous year.

The Children's Party arranged bv the Norwich Gas-Works Social Club proved a great success, no fewer than 230 children of members being entertained. Another social event—the first of its kind since the inception of the club—was also thoroughly successful. A company of about 180 were present at a social and dance, at the invitation of the President (Mr. C. Rhodes Armitage) and Committee of the Club.

Despite Strong Opposition from the Corporation owned electricity undertaking, the Gas Industry in Swindon is effecting almost phenomenal progress in all departments. The sales of gas appliances have increased by 73% over the previous year's figure, and the consumption of gas has increased by nearly 20 million c.ft., with 900 additional consumers. No doubt the chief incentive to this extraordinary advance is the fact that the price of gas is now down to the pre-war figure—9d. per therm, compared with 13·8d. in April, 1932. The amount of concessions given to consumers during the last 18 months averages £7000 per year. As a result of the demand for gas and appliances more than £2000 extra was paid out in wages to Swindon people, as compared with the previous year.

Loch Ness Monster Visits Stretford

A MONSTER SUPPLY of HOT WATER
from the "K.C.U" WATER HEATER
I DON'T CLAIM THAT A K.C.U. WILL FILL LOCH NESS BUT WE DO KNOW THAT IT WILL GIVE MORE THAN ENOUGH HOT WATER FOR ALL YOUR DOMESTIC REQUIREMENTS

Weary of the lamentable lack of publicity which his efforts have aroused at his Scottish home in Loch Ness, the Monster has decided to join forces with the Gas Industry, where, as he is doubtless aware, the value of topical publicity is fully appreciated. As will be observed from our photograph, Col. W. M. Carr has secured the services of the Loch Ness Monster at Stretford, where, assisting in a showroom window display, he has created a tremendous amount of local interest. The window is covered with green tinted cellophane paper which gives the impression of a tank, the general effect being most realistic. The Stretford and District Gas Board state that they will be pleased to give any gas undertaking full details of this display upon application.

THE NEWS—*continued.*

A Prize-Winning Essay in the Aneurin Williams Memorial Essay Competition, which is organized by the Industrial Co-Partnership Association, was written by Mr. Stephen Upton, of the South Metropolitan Gas Company, who has been awarded £4.

New Petrol Plant.—Work commenced last week on the erection at Billingham-on-Tees of the Imperial Chemical Industries' new £2,500,000 coal oil plant. The plant, when completed in about a year's time, will manufacture 100,000 tons of first-grade petrol annually.—From the *Financial Times.*

New Showrooms and Offices for the Bath Gas Company were opened in Old Bond Street, Bath, on Monday of this week, by Dr. E. L. Burgin, M.P., Parliamentary Secretary to the Board of Trade. We shall be publishing a fuller account of the opening ceremony, together with a description of the new premises, in our issue next week.

Another Triumph for Gas Lighting.

Southwark Council has concluded a ten-year agreement with the South Metropolitan Gas Company for the installation of 1000-c.p. high-pressure gas lamps in the Old Kent Road. The new lamps will be centrally suspended.

As new mains have to be laid, the scheme will take some months to carry out. When it is complete, there will be 28 miles of high-pressure gas lamps in South London streets.

Gas lighting predominates in the streets of Southwark, and also in Camberwell, Deptford, Greenwich, and Lewisham.

Of Southwark's 65 miles of streets only about 11 miles are lit by electricity.

Municipal advocates of electricity for street lighting have been discouraged by recent breakdowns of electricity that have placed whole districts in darkness.

Salvation of the Coal Industry.

At the annual dinner of the South Wales Institute of Engineers Sir John Cadman, Chairman of the Anglo-Persian Oil Company, said that hydrogenation of coal, while chemically interesting was more likely to produce white elephants than black diamonds. He outlined his proposals for the improvement of the coal trade, the salvation of which he put in conversion of coal not into oil, but into gas.

For many industrial, commercial, and domestic purposes, he observed, a liquid fuel was very convenient. For most purposes, however, gas was better still, and he thought that coal would ultimately benefit far more from the traditional process of gasification than from any novelty such as hydrogenation. He thought that when gas was placed on an equal footing with its competitors the coal industry would receive a great stimulus towards prosperity.

Support for British Industries House.

The following statement has been issued by the Board of British Industries House:

Encouraged by the support promised by buyers, both British and foreign, in the scheme for the establishment of a buying and selling centre for British goods at British Industries House, the Board has decided to proceed at once with the erection of showrooms and show-cases on the chief floors at British Industries House. This, it is felt, will not only enable manufacturers to visualize more effectively the appearance of British Industries House when it is completed, but will also enable exhibitors who have already booked space to make arrangements without delay for equipping their stands.

It is confidently anticipated that within the next few months sufficient firm bookings will have been secured to enable British Industries House to open as a central buying depôt for British goods both from the Home Country and the Dominions and Colonies overseas.

The Buyers' Club will be ready for use before the rest of the building, and in anticipation of the arrival of the large numbers of overseas buyers who each year visit the British Industries Fair, the Board has decided to open it next month.

Through the Buyers' Association of Great Britain, which, with a membership of over 600, has already established its headquarters in British Industries House, the Buyers' Club is already assured of more than sufficient support to keep it busy, and it is felt that a business club in London in such a central position will be greatly appreciated by overseas buyers, particularly during their visit to the British Industries Fair. All recognized buyers visiting the Fair will be admitted to honorary membership of the Club for the period of their stay in London.

Cookery Demonstrations to Irish Housewives.

Housewives of Ballymena, N. Ireland, attended in full force the cookery lectures arranged by the Ballymena U.D.C. Gas Department at the Town Hall during the week from Monday, Jan. 8, to Friday, Jan. 12.

Miss D. J. Baker, First-Class Diplomée, N.S.T.C., of Radiation Limited, using two "New World" cookers, demonstrated twice daily the reliability and excellence of these ovens. The menus chosen were comprehensive and whole dinners cooked in the oven without attention caused especial comment.

Attendances averaged 260 people per day of two sessions, and by the questions asked and answered these lectures proved extremely popular and aroused considerable interest.

Institution of Gas Engineers.

Members of the Institution of Gas Engineers are invited to attend the next Meeting of the Institution of Chemical Engineers which will be held in the Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1, on Wednesday, Jan. 31.

The Chair will be taken by Mr. J. Arthur Reavell at 6 p.m. and the following papers will be presented:

"The Washing of Gas," by Mr. H. Hollings, M.Sc., A.I.C., and Mr. L. Silver, B.Sc., A.R.C.S., D.I.C., A.I.C.

"Multi-Stage Washers," by Mr. L. Silver.

An abstract of the two papers can be obtained from Mr. J. R. W. Alexander, Secretary of the Institution of Gas Engineers, 28, Grosvenor Gardens, S.W. 1.

Gas Traction.

For some time the Pontypridd Council has had under consideration the question of gas propulsion for their 'bus service, in view of the fact that both the Gas and Transport Departments are owned by the Council. Reports have been made from time to time by the Council's Gas Engineer and Manager, Mr. David Muir, on this subject, as to the progress being made in the development of gas for traction.

A further step in their investigations was reached on Thursday, Jan. 18, when the Chesterfield Tube Company brought down a Chesterfield Corporation 'bus for demonstration purposes at the request of Mr. Muir. The 'bus was a Bristol four-cylinder single decker which has been used by the Chesterfield Tube Company in their investigation and was in service at Chesterfield up to Tuesday evening. It then did the journey down to Pontypridd, and was put on a trial run without any adjustments or overhauling being done to the engine or gas equipment.

The trial run was carried out over a very hilly district with a load of 32 passengers, and at times was more in the nature of a hill climbing test—in fact, it was the severest test this gas-driven 'bus has undergone.

It was revealed on this run that where the 'bus actually failed to climb a hill on petrol it was able to do so when switched over to gas.

The demonstration run was followed by a lecture and film given by Mr. Marsh and Mr. Toogood, of the Chesterfield Tube Company.

Representatives of 'bus systems and of the Gas Industry attended the demonstration, along with members of the Pontypridd Council, and Mr. D. L. Davies, M.P. for the division.

A most favourable impression was created in the minds of those in attendance as to the possibilities of gas for traction in the Pontypridd area.

Controlled Cracking in Continuous Vertical Retorts

By E. B. Tomlinson, M.Inst.C.E., Engineer-in-Chief, City of Birmingham Gas Department.

In his Presidential Address to the Midland Junior Gas Association on Oct. 5, 1933, Mr. S. K. Hawthorn, of the Birmingham Gas Department, drew attention to the improvements in thermal yield of gas per ton of coal carbonized which would follow the establishment of means for the controlled cracking of the primary products of carbonization. He indicated that this would be particularly beneficial in connection with continuous vertical retorts.

As this subject of controlled cracking has been one of the main lines of investigation carried out by the Birmingham Gas Department during the past eighteen months, it has been suggested to me that it would be of interest to the Gas Industry to indicate the present position of our work on this subject, and give a summary of the phases through which our investigation has passed.

This idea of controlled cracking has been prominent in the minds of designers and investigators of vertical retorts for at least the past thirty years, as will be found from reference to the early work of Settle and Padfield, Woodall and Duckham, and Young and Glover, but in the commercial application of the principle of continuous carbonization in vertical retorts complications in process have naturally had to take second place to the development of a reliable apparatus, thus controlled cracking in continuous vertical retorts never seems to have been pushed forward to commercial success. It is, however, recognized that in static forms of high-temperature carbonization a degree of control of cracking, with or without steaming, is achieved by varying the space above the top of the charge. This is found in horizontal retorts, intermittent vertical retorts, and coke ovens, care being necessary that cracking does not become over-cracking.

The two investigators who figured prominently in the early work in controlled cracking were William Young and Prof. Vivian B. Lewes, both of whose publications show a clear conception of the advantages to be gained by the commercial application of this principle.

Prof. Lewes pointed out in 1904 the need for regulating "the decomposition of the hydrocarbons in the coal," and later, in 1911, re-advocated the cracking space above the charge. Speaking of the difficulty of gasifying liquid tar with any marked success, he said:

> "This applies to tar after it has been condensed and not to nascent tar in the gaseous state as it leaves the decomposing coal. . . . Catch it in the nascent state and heat will gasify it. . . . If any really important results are to be obtained from tar as a gas producer, it will be on these lines and carried out in a vertical retort, so that radiant heat alone acts, and contact is reduced to a minimum."

More recently, in the William Young Memorial Lecture of 1928, Mr. E. V. Evans, of the South Metropolitan Gas Company, indicated that it was William Young

> "who had placed his finger on what may be considered to be the secret of the effective carbonization of coal, and that is the carefully controlled cracking of hydrocarbons in the presence of hydrogen."

In May, 1932, Mr. S. K. Hawthorn re-introduced to me the subject of cracking in continuous vertical retorts, and designed a coal feed whereby the charge of coal could be kept at any pre-determined depth below the top of the brickwork, the coal being fed mechanically on to the top of the charge in small quantities and very frequently.

The Birmingham Gas Committee decided to make a full study of this subject, and an experimental programme was laid down in order to determine the possibilities and limitations of the process.

This decision was reinforced by work on somewhat similar lines carried out in 1925 at the Birmingham Coal Test Works by Mr. T. F. E. Rhead, Chief Chemist of the Birmingham Gas Department. This work was partly referred to in a paper to the Institution of Gas Engineers in 1926 (see Transactions 1925-26, p. 312).

The more recent and main experimental work which commenced in July, 1932, has been mainly carried out at the Coal Test Works under the direction of the Chief Chemist, Mr. T. F. E. Rhead. In view of the work being carried out on the Woodall-Duckham Company's design of retorts, the Gas Department availed themselves of their co-operation in the work.

The Gas Department would also like to acknowledge the helpful advice of Mr. E. V. Evans, of the South Metropolitan Gas Company, whose extensive investigational work in controlled cracking is well known.

The first step was to determine whether an increased thermal yield could be obtained by subjecting the gas within the retort to further heat treatment. To effect this it was decided to use the charging device* previously alluded to for feeding small quantities of coal at regular intervals into the retort, and by so controlling the extraction of the coke to keep any predetermined space at the top of the retort. By this arrangement it was possible to vary this space, and on one coal a series of tests was run with the level of the top of charge varying from full retort to 9 ft. down from the top.

It was found that optimum results were experienced with the coal charge about 7 ft. down. As the level approached full retort conditions the effect on gas yield diminished. At greater depths than 7 ft. there was evidence of over-cracking.

Under the optimum conditions of cracking with the first coal tried, the following is a summary of the results:

Under controlled cracking conditions with 14·5% steaming, the therms of gas per ton were 84·8 of 528 B.Th.U. per c.ft., with a throughput of 5·2 tons per day; under normal vertical retort conditions, with 12·3% steaming, the therms per ton were 81·6 of 477 B.Th.U. per c.ft. with a throughput of 6·1 tons per day. Calculated on a basis of 475 B.Th.U. per c.ft. in both cases (by the addition of blue water gas of 300 B.Th.U. per c.ft.) the therms per ton are 99·4 and 82·3 respectively. The equivalent horizontal retort figures were 72·0 therms at 543 B.Th.U. per c.ft., or 87·5 therms calculated on a basis of 475 B.Th.U. per c.ft.

This clearly indicates the actual possibility of improving the yield of "straight" coal gas on continuous vertical retorts. Similar results have been obtained from various types of gas coal.

Considerable difficulty was experienced in the early experiments with deposits in the offtakes and foul mains, but this was overcome by adopting the Woodall-Duckham system of effectively spraying the offtakes.

Accurate control of gas pressure conditions is essential.

The coke structure was modified, giving a coke of higher bulk density than that from ordinary continuous verticals. The properties and commercial value of this coke are being investigated. It is intended to study the effect on the coke structure and the controlled cracking process of carbonizing blended and/or mixed coals; incidentally several of the coal feeds previously alluded to lend themselves to this purpose.

The tar was modified, and showed many characteristics of horizontal tar. The quality of the benzole is also being investigated.

Certain limitations were encountered in the commercial application of this method of working, which may be enumerated as follows:

(1) Independent feed of coal requires synchronizing with coke extraction, and this increases mechanical complication. The feed adopted involves using small coal. This is not necessarily disadvantageous.

(2) When dusty coal is dropped 7 ft., a large amount of dust is carried over with the gas. (Dust refers to that portion of the coal passing 100 mesh (I.M.M.) sieve.)

(3) Leaving a cracking space at the top of the retort reduces the effective heating length and eliminates the normal heat interchange between gas and coal in the upper part of the retort, thus reducing throughput. This reduced heating length does not help steam cracking, and this, together with the improved thermal yield of "straight" gas made, results in higher calorific value of the final gas.

Having established the technical possibilities, it was decided to explore alternative means of effecting controlled cracking. The logical step to overcome the mechanical complications of a separately controlled feed synchronized with the coke extractor was to connect the normal reservoir of coal above the retort to the lowered surface of the coal within the retort by means of some pipe or trunk. By this means it was aimed to secure a cracking surface within the retort without departing from the present principle of the rate of coke extraction governing the rate of coal flow.

The proposal to introduce coal into a continuous vertical retort through a pipe or trunk has been in the minds of plant designers from earliest days. For example, it is specifically shown in the original Woodall-Duckham patent of 1903. There has, however, been little work done to use such a feed for creating a free space at the top of the

* Many available methods of feeding the coal were considered, such as worm or screw, rotary drum, rotating table, short belt, and shot-pouch, but for the earlier tests a horizontal reciprocating plunger feed was selected.

retort. Mention, however, should be made of the work of Mr. A. H. Burton, of the Warrington Gas Department, who, independently of ourselves, has, I understand, been working on this idea of introducing coal through a centrally disposed trunk to such a depth within the retort as to cause controlled cracking.

At Birmingham, based on our optimum results, when maintaining a cracking space by independent coal feed, we have worked with a pipe extending to such a depth that the cracking space approaches the same dimensions as before. By reason of the relatively high velocity of coal passing down the pipe, no blockage is experienced, but, of course, the pipe has to be removed at scurfing times.

It has been established that this deep pipe feed gives definitely improved " straight " coal gas yields over normal full retort working. It is yet too early to indicate whether this simple device can be regarded as a commercial success. There are certain technical features yet to be investigated. For example, what taper, if any, is required in the pipe?

While nuts work satisfactorily, run-of-mine coal may require crushing somewhat smaller than usual. Further, it is necessary to secure that the gas-ways on each side of the pipe are kept clear. For this reason, there may be advantage in applying a modified form of the Woodall-Duckham asymmetric trunk feed, the modification being to increase the length suspended in the retort. This asymmetric feed was developed specifically for the treatment of slack coals, but a longer type may be found to have advantages for carrying out controlled cracking.

In conclusion, it may be stated that the position we have now reached is that the pipe feed method of introducing the coal to such a depth as to ensure controlled cracking is in course of being tried out on a range of continuous vertical retorts with a daily carbonizing capacity of 100 tons per day. It is hoped from these tests to judge the commercial aspect of the process, special attention being paid to coal throughput, calorific value and yield of gas, quality and yield of coke, benzole, and tar. In due course, we hope to be in a position to give an account of our work to the Industry.

The "Union" Dry Recording Calorimeter

A. Rohr, in Bulletin des Schweiz. Vereins von Gas- und Wasserfachmännern, 1933, 13, 301-303 (Dec.), describes the dry recording calorimeter made by the Union Apparatenbaugesellschaft Karlsruhe.

The two essential requirements for the accurate recording of calorific value are fulfilled—namely, maintenance of a constant pressure at the inlet to the calorimeter and automatic correction for variations in the specific gravity of the gas. The governor employed is the one made use of in connection with the Junkers calorimeter. The efficiency of the specific gravity control is evidenced by the fact that the readings of the dry calorimeter agree with spot tests made with a hand calorimeter even when wide fluctuations of specific gravity occur.

The new calorimeter is contained in a cast light-metal case approximating 27½ in. high, 14½ in. wide, and 7 in. deep. The instrument is thus very compact. The clock is an eight-day one, and a roll of recorder paper lasts for four weeks.

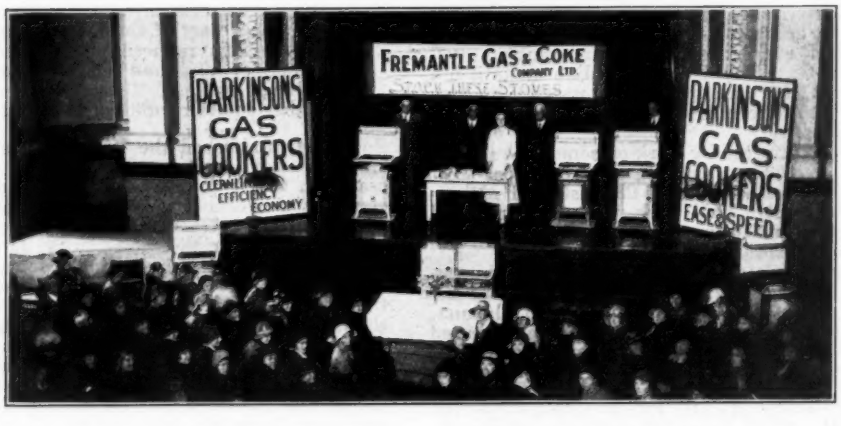
The gas enters by way of a governor, and, after traversing a small filter, passes through an orifice into a distribution chamber to which is connected a manometer which enables the pressure to be verified, and a specific gravity compensating device. This consists of a compensating orifice leading by way of a telescopic tube to a burner for the surplus gas. These portions are all outside the case of the instrument. The calorimeter burner passes into the case from the distribution chamber and consists of a small, multiple flame, quartz glass burner. Air is supplied to the burner as in the case of a Teclu burner. The combustion gases pass into and give their heat to a hollow, horse-shoe shaped vessel, and thence leave the instrument. Air entering at the bottom of the case transfers the heat of combustion to a ring-balance mechanism surrounded by the horse-shoe vessel. The ring-balance is filled with a liquid from one end nearly to the other, and expansion of the liquid towards the unfilled end under the influence of heat rotates the balance, the movement being transmitted to the recording pen. A compensating balance situated at the bottom of the case and working in the opposite direction takes care of variations in the atmospheric temperature.

The telescopic tube fitted to the distribution chamber is graduated and may be extended or shortened for the purpose of adjusting the reading of the instrument so that it agrees with a standard hand calorimeter. This adjustment is made without the necessity of opening the case of the instrument. An alteration of 4 in. in the extension alters the reading by about 1 B.Th.U. per c.ft.; hence the regulation is very sensitive.

The calorimeter has been employed at the Wetzikon gasworks with entire satisfaction. Since it works on the dry principle, the movement of the pen arm is a function of the net calorific value of the gas, though, for a particular gas, the chart may be graduated in terms of the gross value.

The cost of the instrument is one-half of that of a first-class wet recording calorimeter and the running costs, when the instrument is debited with the cost of the gas consumed, are stated to be approximately one-third as great. The gas consumption is only 3 c.ft. per hour.

Cookery Demonstrations in Australia



Our photograph shows a gas cookery demonstration in progress at Fremantle, Western Australia, being one of a series which the Australian subsidiary of the Parkinson Stove Company, Ltd., is holding in various parts of the country. These demonstrations have been very successful and have helped considerably in bringing before the public the advantages of gas for cooking.

LIGHTING OF THE TOWER BRIDGE

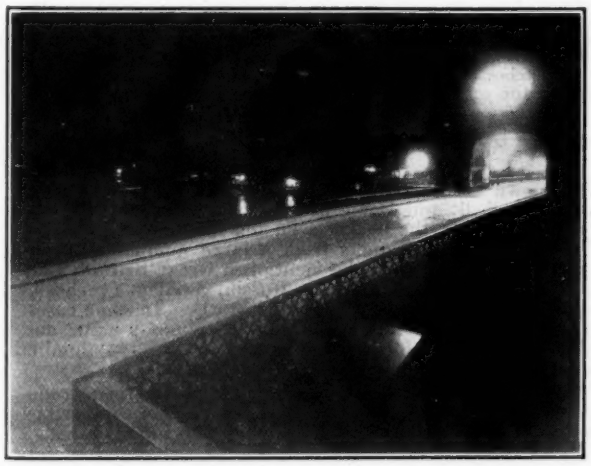
A NOTABLE TRIUMPH FOR GAS

THE TOWER BRIDGE, LONDON.

The Tower Bridge, London, with its distinctive form, lives in memories all over the globe, for there are very few visitors to London who leave without seeing it. It is the first bridge, from the sea, over the Thames, and forms a portal to the great City of London which is befitting in its dignity and grandeur.

The Bridge was designed by the then City Architect, Sir Horace Jones. One of the conditions imposed at the time was that the structure must be in keeping architecturally with the historic Tower of London, which lies adjacent to the northern approach, and from which, of course, the Bridge takes its name. The original designs were carried out in a modified form by Sir J. Wolfe Barry, as Sir Horace Jones died in 1887, when the foundations had made little progress. The modifications were important, involving an increase of span and other dimensions, a difference in the high-level bridges and other parts, so that actually Sir J. Wolfe Barry carried the whole thing through from the original sketches.

The Bridge was opened on June 30, 1894, by the then Prince of Wales, afterwards King Edward VII.; and, since this article is mainly concerned with the lighting of the Bridge, it is interesting to note that this was provided by Sugg's lamps. Various alterations and improvements to

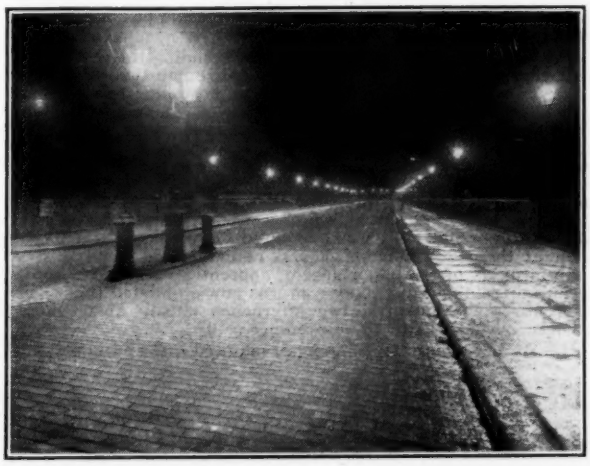


THE LIGHTING OF THE BASCULES.

the lighting were carried out from time to time through the years, but, as the bascules which form the central portion of the bridge are lifted at regular intervals for the passage of shipping, the problem of their adequate illumination had not been satisfactorily solved until the installation of the present scheme.

With the very much higher standards of public lighting now generally adopted, the Bridge Authorities realized that it was necessary to raise the standard of lighting the bridge in accordance with modern traffic requirements. As the result of experiments and investigations, a system of low-pressure gas lighting employing superheated clusters of small mantles was adopted as being the most advantageous from every point of view, the units employed being designed and tested for their particular purpose in the laboratories of the South Metropolitan Gas Company.

The scheme adopted includes sixty-one lamps of the "South London" and "Grosvenor" types, glazed with bent panes, and each carying a cluster of six No. 2 mantles. These lamps, which are surmounted by the City Arms device, are carried on columns mounted on the footpath on the south side, and on the balustrades in the case of the north approach. The south side is also provided with two particularly fine examples of illuminated guard posts, lighted, of course, by gas.



THE APPROACH FROM THE NORTHERN, OR CITY, SIDE.

The most interesting part of the installation is, however, the lighting of the bascules, which is achieved by mounting three flood-lamps in each of the main towers. These flood-lamps each carry six No. 2 mantles, and are provided with reflectors of chromium-plated copper specially designed by the South Metropolitan Gas Company. In addition, special "armour plate" glass is used for those windows of the towers through which the floodlamps throw their light.

The fine lighting which the flood-lamps provide is indicated by the night photograph shown. The installation is completed by the provision of a six-light "Rochester" suspension lamp with special reflector under each of the main arches leading to the bascules, the light from these lamps illuminating the arches themselves and merging into that from the flood-lamps, and also two six-light "Rochester" lamps under the ferry arch on the north side.

The new Tower Bridge lighting is the joint responsibility of the South Metropolitan Gas Company and the Commercial Gas Company, and both are to be congratulated on the very fine results obtained; all the lamps and fittings were made—as at the opening of the Bridge nearly forty years ago—by Messrs. William Sugg & Co., Ltd.

Theory and Practice on the District

In a paper before the Midland Junior Gas Association at Birmingham on Dec. 7, 1933, Mr. G. H. Davies, of Hereford, emphasized the importance of a well-organized distribution department and paid tribute to the able manner in which the designers and manufacturers of gas appliances have met the needs of the Gas Industry. He thought a feeling of antipathy often existed between the technical man and the artizan; and in pleading for the team spirit he asked that each should recognize the contribution of the other.

To support his contention that theory does not always fit in with practice, Mr. Davies recounted some of his personal experiences in dealing with various difficulties on his district. It is essential, he said, that everyone who is responsible for the tackling of problems on the district should go to these problems with an open mind and not be bound by any previous theory.

The author described the installation of high-pressure gas lighting in a street in Hereford, and stated that the result had brought commendation from the public.

Regarding the education of juniors in the Industry, Mr. Davies is strongly of the opinion that all pupils, in manufacture and distribution, should be required to take a short course of practical work.

Discussion.

The PRESIDENT (Mr. S. K. Hawthorn) said that distribution systems were apt to be taken very much for granted, but it was most essential that the utmost care should be taken to ensure their efficiency, especially when outputs were increasing. The gas engineer or the engineer of works could practically re-build works in the space of a few years, but the distribution engineer never had the advantage of being able to start with a clean sheet. He was nearly always faced with problems arising from extensions, and the renewing of old mains; he had frequently to make the best of a system which had been put in many years ago, and then without sufficient regard for the needs of the future.

Mr. F. A. C. PYKETT (Coventry), in moving a vote of thanks to Mr. Davies, said most undertakings now realized that it was one thing to make a product, but quite another to sell it. The task of selling was often a difficult one, and he quite agreed that effective propaganda and salesmanship could be done by men engaged in manual work.

Mr. J. H. WAINWRIGHT (Halesowen), seconding the resolution, said that, as a general principle, practice must come before theory, but theory assisted practice to a greater extent than was indicated by the author of the paper. It seemed to him that gasfitters could be a real service not merely in fixing equipment in houses, but in pointing out to consumers the advantages to be gained by using certain types of apparatus. With regard to high-pressure lighting for public, he would like more information as to the pressure that was maintained at the works; also whether the high-pressure boosting plant was used at any time other than when required for public lighting. He thought there was a more general realization in the Industry than formerly of the importance of apprentices receiving proper technical training, and many concerns now stipulated that their apprentices should spend two afternoons weekly at technical schools, in addition to three evenings.

Mr. W. N. SMIRLES (Birmingham) inquired if the author would agree with him in his contention that terminals would always work correctly if they were fitted in an exposed position.

Mr. J. C. WHITEHOUSE (Birmingham) pointed out that the smaller gas undertakings were not in a position to employ their own architects. They had to engage the services of local members of the architectural profession, and his own experience was that some of them at least did not appreciate the gas engineer's point of view. On one occasion recently an architect had declined to carry out his suggestion to run a flue up to the apex of the roof in order to allow of the discharge of gas from an engine. In carrying out work on the district it was in his opinion necessary that full records should be made by efficient practical men, either in descriptions or by sketches, of the dimensions of mains and even the position of the joints to the pipes. Information of this kind, carefully plotted and stored away in the office, was often of material assistance at a future time. He would like to know whether Mr. Davies had any experience of wrought-iron mains, completely welded.

Mr. J. C. COTTERILL (Worcester) said that, in view of the housing developments in the outlying districts of large towns, high-pressure plant had become essential, and he inquired if Mr. Davies had had any experience of high-pressure boosting plant at the works with the feeder mains running to the outer part of the district.

Mr. A. HILL (Hon. Secretary) spoke in defence of the architect, and said his experience was that architects in general practice were usually prepared to accept the suggestions of the man engaged on the works. It was necessary that the engineer should state clearly what he wanted; and while he agreed that architects' plans could not always be carried out, he thought that, generally speaking, proper effect could be given to them when alterations were made regarding points of detail. It was necessary that the gas man should recognize that the architect had all classes of work to do, and that what was required on a gas undertaking was often of a special character.

Mr. DAVIES, replying to the discussion, believed there were many intelligent fitters who could carry out effective propaganda and even sales work, because of the closer contact they had with the consumer than had inspectors and others in an administrative capacity. Regarding high-pressure work, he said that at Hereford they worked at 8-in. pressure at the works and 6-in. pressure on the district. The air boosting system was at the works itself, and they had taken a separate high-pressure main leading to the outlying districts to the district governors. From the same boosting plant they took their supplies for high-pressure lighting. Regarding the education of apprentices, he was glad that definite progress was being made in many districts, and his hope was that technical training as distinct from practical work would be made compulsory. Regarding down-draught terminals he had always felt that if a flue was carried up beyond the ridges of the roofs, no trouble would be experienced. He did not think they realized sufficiently the effect of upward pull and downward draught. Much trouble came from the inside and was due to the position of doors and windows. He had not, he hoped, suggested that architects were not helpful to the staff on the works and the district. Conferences were often necessary, and by these some general principle was adopted and carried out; but he had found that architects and builders were electrically minded. His own preference was for the welded wrought-iron main, believing that it had many advantages, particularly in districts where there were subsidences. In his opinion the importance of making plans and sketches of new and existing mains could not be exaggerated in the economy of time that they might effect.

BOOK REVIEW

TRADE-NAMES IN THE REFRACTORY MATERIALS AND FURNACE CONSTRUCTION INDUSTRIES.*

The technical section of a firm of furnace or carbonizing plant constructors is often faced with a question such as "What are the characteristics of Incognita brand bricks?" Before such a question can be answered it may be necessary to get into touch with the makers of this type of brick, a difficult task if the name of the makers is unknown. Difficulties of this nature may often be solved by reference to a very useful list of trade-names, which has just been published. The author has, from time to time, contributed lists of trade-names and the names and addresses of their owners to Feuerfest, and has now collected them together under one cover, at the same time adding a large number of extra ones. The extended list contains nearly 1500 items and includes not only proprietary refractory materials of all kinds, but also jointing, pointing, and patching cements, insulating materials, and items of plant or machinery employed in the refractory materials and furnace industries. Among these may be mentioned a few types of furnaces and ovens known by special names, grinding machinery, excavating plant, air heaters, burners, &c. Among the well-known designations to be found are Douglas, Nettle, Lava, Bluebell, and Dome bricks, Pluto, Purimachos, and Pyrolite cements, the Becker oven and the Four Oaks spray. The list includes products from a large number of countries, among which may be mentioned Great Britain, Germany, France, Belgium, Italy, Russia, Sweden, Czechoslovakia, Switzerland, and the United States. In some cases, in addition to the trade-name and the maker's name and address, further information is given—*e.g.*, 43% alumina is indicated as a characteristic of Nettle bricks.

The main list is followed by a mere list of American trade-names contained in an American survey of refractory materials. These items are not included in the main list.

Then comes a numbered schedule of two hundred important books dealing with furnaces and allied subjects. There is also an alphabetical list of a vast number of different types of furnace, each item being followed by numbers indicating the books to which reference should be made for a good description of the particular kind of furnace in question.

Finally comes a list of all the books and original papers written by the author over a number of years.

The work will serve a very useful purpose, though it is admittedly not complete and is not free from errors. The author will be very grateful to owners, throughout the world, of trade-names for refractory materials, furnaces, &c., if they will send him particulars of their products for inclusion in subsequent editions.

* Markenzeichnungen im Feuerfest-Fach und im Ofenbau, by L. Litinsky. [Leipzig, 1934. Pp. 98. Price RM. 6, unbound.] Copies are obtainable from the Author, Thiemstr. 6, Leipzig O 27, Germany.

The Education, Training, and Development of the Gas Engineer and Manager*

By Colonel W. M. Carr.

I have chosen for my Address to-day a subject which cannot be dealt with in few words, a subject upon which opinions must necessarily be very divergent; nevertheless, I think it is one of absorbing interest to all concerned in the technical administration of the Gas Industry.

In considering the best means of fitting oneself for a particular occupation, one must form an appreciation of what is required in the satisfactory fulfilment of such occupation. I know of no industry which calls for more all-round qualifications in the individual than the one we serve, as the majority of its undertakings are controlled and administered by an engineer and manager who must have had broad scientific training, and extensive training in commerce.

What does the gas engineer and manager require to know? It is with some trepidation that I endeavour to answer this question. I am indeed aware that the answer I now suggest can only be indicative of the extensive all-round knowledge that the position requires.

1. He must be knowledgeable in mathematics, and have a clear understanding of figures, and their manipulation to convey information.
2. His general scientific knowledge, particularly in chemistry and physics, must be sound and extensive.
3. His engineering knowledge, both civil and mechanical, must be such as to enable him to design and construct any works arising as part of, or in conjunction with, the manufacture and distribution of gas.
4. His general knowledge of science and engineering must extend to all branches of manufacture to enable him to appreciate and develop the utilization of gas in industry.
5. He must have sound commercial training to permit him to make true appraisement of values.
6. He must have sufficient knowledge of secretarial work, and law, for the successful administration of an undertaking working under Statute.

These are, I suggest, the general qualifications required from a gas engineer and manager.

It is clear, therefore, that his education must commence in a broad sense, and we all, I know, appreciate the necessity of sound elementary education.

Elementary Mathematics.

In my experience, I have found that many people are afraid of figures, and look upon a Statement of Accounts as something that is produced in a mysterious manner, and eventually gives a result and cost which may mean something or nothing. This is a result of what I think is a weakness in our teaching of elementary mathematics; one is taught to manipulate figures by addition, subtraction, and division to produce a result. I suggest that if we were taught to use figures to convey a meaning to the mind as we are taught to use letters—in other words, taught to read them and their meaning rather than to manipulate—a lot of the inherent fear in the individual of statements of figures in later life might be overcome.

If we assume that the prospective gas engineer and manager has pursued his general education to what is commonly called the Matriculation standard, the question arises, should he then take up his duties in a gas-works or should he proceed to a University?

So far as my personal experience is concerned, on leaving school at the age of seventeen, I took a two years' General Engineering Course at the Victoria University of Manchester. The whole of my vacations during that Course were spent in gas-works.

[At this stage Col. Carr stressed the point that gas-works should provide facilities for University Students desirous of gaining practical experience during their vacations.]

At the end of my University course, I served for two years in a Civil Engineer's office, principally engaged in bridge building and dock work, so that I was of age before commencing in gas-works, with the exception of the vacations I have mentioned.

I think it dangerous to dogmatize on the point as to whether the prospective gas engineer should spend three years at a university. Generally speaking, and depending upon the individual, I think it is desirable, although I am not certain that it is most desirable that the university degree taken should be a Gas Engineering degree rather than a general science degree.

I believe that there is a tendency for many of us to commence to specialize too early, and it is my opinion that the post of manager of a gas undertaking cannot generally be satisfactorily filled by someone whose training has been specialized.

We all know considerable numbers of successful technical administrators of gas undertakings who have not been to a university, but who have embarked on their practical training in gas-works direct from school. The largest percentage of our students in the Industry to-day are within this category, and the Education Scheme of the Institution of Gas Engineers is particularly designed to cater for their education in these circumstances.

A strong argument can be advanced in favour of the student proceeding to his training direct from school, and continuing his education at Continuation Classes, the principal one being that there is so much to learn that practical experience should commence as soon as possible.

The student who aspires to be not only a gas engineer, but also a manager of a gas undertaking, requires to look further ahead than the Diplomas in Gas Engineering and Supply. These are only preliminary essentials for the position he seeks. He must equip and qualify himself commercially as well as technically if he is to be a successful administrator.

I think that all students who are training for managerial positions should take an Accountancy Course, and, even more important still, the Salesman's Course of the British Commercial Gas Association.

I appreciate that if this is to be done, the student commencing his training in a gas-works, say, at the age of sixteen, must of necessity continue his studies until the age of twenty-four or twenty-five. Forgive me if I repeat a truism in stating that one's studies are never completed, and we technical gas administrators find that the time we have to devote to reading, outside the demands of our normal day's work, in order to endeavour to keep up to some extent with the development of our Industry, increases year by year.

Training in the Gas-Works.

Turning to the system of training in gas-works, the time that is to be spent in the various departments must depend, in a measure, upon the capacity and adaptability of the student.

I believe that a year in the workshops on practical mechanical work in connection with works maintenance, &c., is very desirable. Included in this, or in extension of it, I think some time should be spent in the meter and stove repair shops. It is perhaps best to carry out this practical work at the commencement of training. This should be followed by a period of at least twelve months in the drawing office. I am, of course, assuming in this instance that the student is in one of the larger or medium sized gas-works.

The student should then have at least two years in the laboratory, and receive a thorough grounding in the principles not only of routine tests, but of chemical control of our manufacturing processes. The laboratory training should include a period of at least four to six months in the analysis of fuel and the evaluation of coals.

I then suggest that the student requires to be at least twelve months in the distribution department, which should include time with the inspection staff, main and service laying, installation, maintenance and testing of street lighting, and the installation of consumers' appliances. Throughout this training, the student should be required and called upon to carry out such work as will ensure that he is able correctly to appraise the value of labour and material.

Sales Training.

Following this, the student should be employed on the selling staff, and be given a full insight into both domestic and industrial salesmanship. This is the part of the training of the gas manager which I respectfully suggest has been too much neglected in the past. I say this from my own experience, for when I commenced to develop an intensive campaign for the sale of industrial gas some years

* Précis of an Address before the Joint Meeting of the Western and Eastern Districts of the Scottish Junior Gas Association, Glasgow, Jan. 13.

ago I became very much aware of my deficiencies and shortcomings.

You will probably say—How are we to obtain the varied general training within the undertaking we serve? My answer is that it is a question to which all of us who are responsible for the conduct and control of gas undertakings must give the most serious consideration to ensure that all-round facilities are provided for trainees as technical administrators.

I believe that the technical and commercial man combined is usually the most suitable for the management of an undertaking, as it is desirable that he should have the technical knowledge to guide his decisions in important matters of administration.

I must say, however, that it is equally true that the technical official without commercial training, knowledge, and ability should not be promoted to the position of engineer and manager, in which position, in most undertakings, administration and selling form the major part of his work.

My Address to-day is, I appreciate, in somewhat unusual form. I have ventured to put forward my views in the hope that they may assist in the consideration of one of the most important of all our problems—the training of those who are to maintain and develop the great Industry which we are so proud to serve.

Discussion.

Mr. JOHN GREIG (Vice-President of the Western District, who occupied the chair) said that they had been fortunate in having had such a stimulating address from Col. Carr. He did not think, however, that it would be possible in every works to carry out the suggested scheme of training, as it would be difficult to provide facilities for six months' study and six months' practical training and to arrange for transfer of juniors from one department to another. Such a course would, he thought, be unfair to those who would require to act as permanent instructors in each department.

Mr. W. SCOTT (President of the Eastern District) said that from what they had heard, the gas engineer was a wonderful being who must possess an amazing amount of common-sense. The subject of practical training and the classes organized by the Institution of Gas Engineers had been mentioned, and Mr. Scott thought the examinations of the Institution provided merely a guide to a small part of the ground which had to be covered by a student. A pass in these examinations did not necessarily qualify a man to hold a position as manager. He then asked Col. Carr to which qualifications, practical or theoretical, he would give most consideration if he were required to appoint a manager to a medium sized works.

Mr. A. A. MACFARLANE (Glasgow) suggested that it was desirable that costs should be available to juniors, as at present the only opportunity most juniors had of seeing these was when the annual returns were published. With regard to training for the Industry, he thought that an example could be taken from the Civil Engineers. They had insisted on all students attaining the Higher Leaving standard of general education before proceeding to a specialized course. This was a plan which might well be adopted by the Institution.

Mr. DAVID FULTON (Helensburgh) said that they had had an address from a man who had the courage of his convictions. This address was full of good Lancashire common-sense, which, Mr. Fulton said, was almost as good as Scottish common-sense. He could not disagree with anything which Col. Carr had said, but the training of the gas engineer was so comprehensive that there was no common path. Col. Carr had indicated one path, but there was an infinite variety of paths. He reminded juniors that the road to success was not made of tarmacadam. Juniors must not expect to have everything done for them. He did not think that because a man remained in one department it was impossible for him to gain a knowledge of other branches, since a man with the proper spirit would make it his business to gain an insight into the work of others. He was against any hard and fast scheme of training, as this would tend to produce robots. He hoped that as long as he had anything to do with the educational policy of the Institution he would be able to prevent any lack of elasticity in the scheme of training. He thought that it would be a grave mistake to close the doors of the Institution to all but matriculated students.

Mr. J. BELL (Dumbarton) remarked that a course of technical training had now been laid down, and with this the student must comply. Technical training did not give the student two most important factors—commercial and administrative training. About 75% of the average gas manager's time was occupied on the commercial and administrative side. The engineering aspect was still very important, but had been simplified by the standardized methods which were now in use throughout the country. In Dumbarton he provided every facility for the training of the junior. The first three years were spent as a fitter, and this gave a thorough insight into all aspects of distribution work. Then the junior entered the works, where he had experience in the repair shop, in the control and heating of retorts, and in laboratory testing. He then entered technical classes and was able to correlate the practical with the theoretical. At all times he was allowed access to returns and costs, and obtained a knowledge of the methods of buying and selling. Thus, when a junior finished he was equipped with an all-round knowledge.

Mr. R. D. KEILLOR (Greenock) asked Col. Carr how he would assess common-sense.

Mr. S. MCGOWN (Glasgow) remarked that Col. Carr had stressed the importance of the commercial side. He thought that seniors should give juniors every opportunity of gaining this experience. In connection with the proposal that university students should spend the vacations in gas-works, Mr. McGown suggested that it would be a very good thing if bursaries could be arranged to permit juniors from gas-works attending university classes.

Mr. SMITH (Dunfermline) referred to Col. Carr's uncertainty as to whether his own method of training had been the best. He then instanced the case of two men, one of whom was a public school and university trained man; the other went straight into a gas-works on leaving school. Each went his separate way, and both arrived in similar positions at the same time. He would like to have a definition of student, as the present idea seemed to him to be too much like a premium pupil. Very few works could give the course of training which had been suggested. He suggested that it was a good thing to start in a large concern and then to move into a smaller undertaking, as in the smaller works wide experience would be gained, there not being the same tendency to remain in a water-tight compartment as existed in the large concerns.

THE AUTHOR'S REPLY.

Col. CARR, in reply to Mr. Greig, said that at the outset of his address he had pointed out that opinion must be divided as to whether every undertaking could give the facilities he had indicated. Conditions varied in every case, but he believed that such facilities were possible. In suggesting a course of study, one could not be dogmatic; there were many paths open to juniors entering the Industry, and he had only indicated one of these paths. The path he had outlined led directly to a managerial position. He did not believe in premium pupils, as he did not want people in the Industry who were not keen. He started all his juniors on the same footing, and the scheme he had put forward was a general path upon which anyone entering the Industry might start, as it was essential to avoid specialization at the outset. Replying to Mr. Scott's question, Col. Carr said that if he were faced with the responsibility of appointing a manager he would give preference to a man who had both theoretical and practical experience, but if such a man were not available then he would choose the man with the practical experience. As regards Mr. MacFarlane's suggestion of making the matriculation standard compulsory, Col. Carr said that he was in agreement with Mr. Fulton's views on this matter, and considered that such a step would be dangerous. Everyone should be encouraged to attain the matriculation standard of general education, but no one should be excluded because he had failed, through no fault of his own, to attain this standard. He agreed with Mr. Fulton's views on the danger of lack of elasticity in any scheme of training, and said that the Council of the Institution was always prepared to take every circumstance into consideration. He said he thought Mr. Bell's scheme of training was excellent, and agreed with his contention that the bulk of a manager's time was employed on commercial and administrative affairs. Common-sense, said Col. Carr in reply to Mr. Keillor, was the capability a man possessed for analyzing values. To assess two people on a basis of common-sense, it was necessary to have experience of their work. The man with the most common-sense would start a job by first making up his mind as to what his objective was, and then making his plan; the other man would work blindly by routine methods.

There were already one or two bursaries which enabled young men in the gas-works to attend university classes, and he hoped that the number of these bursaries would be increased. The case of the two students which had been described by Mr. Smith had many counterparts, said Col. Carr, and though Mr. Smith had suggested that Stretford must be a kind of Utopia for trainees he could assure him that unless the trainees pulled their weight it was not a very comfortable place.

Gross and Net Calorific Value.

Arising out of the resolution made at the London Fuel Conference in 1928, consideration is now being given by the International Standards Association (ISA) to the setting-up of international standards dealing with the definition of gross and net calorific values of solid, liquid, and gaseous fuels. The British Standards Institution accepted the invitation of the World Power Conference to undertake to present the British viewpoint as to what was the practice in Great Britain in regard to the definitions of the terms " gross " and " net " calorific value and the way in which they were used.

The British Standards Institution decided that its recommendations, as forwarded to the ISA, should be issued as a British Standard, in order that they might be given full weight in any international consideration which might take place; and the agreed standard definitions of " gross " and " net " calorific value of gaseous, solid, and liquid fuels have therefore been published as a British Standard.

Copies of this British Standard (No. 526-1933) may be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W. 1, price 1s. 2d., post free.

A Simple Laboratory Method for the Assessment of the Combustible Nature of Coke*

By H. E. Blayden, W. Noble, and H. L. Riley.

It is well known that cokes may vary markedly in the readiness with which they react with oxygen. At one extreme there are the highly reactive low-temperature cokes which are readily ignited and burn freely, and, at the other, certain unreactive oven cokes, some of which are difficult to ignite and burn freely only in a forced draught. The combustible nature of a coke is probably determined largely by four factors: (*a*) The physical structure of the coke; (*b*) the allotropic nature of the carbon present; (*c*) the percentage of volatile matter; and (*d*) the nature of the inorganic ash. Although it is possible to determine the magnitude of these separate factors, their individual effect upon the combustible nature of the coke is obscure and it is not possible to predict accurately their combined effect. The increasing demand for screened coke for use in both the cupola and the blast furnace has created a need for an outlet for breeze, and this is being met to a certain extent by the domestic market. The combustible properties of coke for this market are of great importance. The sale of unreactive coke for use in open grates and small slow combustion stoves, where only a limited draught is available, can only detract still further from the popularity of coke as a domestic fuel. The desirability of greatly extending its use, or that of other smokeless fuels, is too well known to need amplification, but this extension can only be brought about by the sale of coke, the combustible properties of which are particularly suited for the required purpose. The pressing need for an apparatus which will give rapidly and quantitatively some idea of the combustible nature of coke, in order to control both production and sale, is therefore obvious.

An apparatus which gives promise of meeting the above requirement has recently been designed in the laboratory of the Northern Coke Research Committee. It is shown in figs. 1 and 2, and consists essentially of a transparent fuzed quartz tube D supported in a large rubber bung J. The coke under examination is carefully sampled and about 600 grammes of it reduced to 10-20 I.M.M. A definite volume of this coke is introduced into the tube D, by filling it to the line etched on the silica, 10 mm. from the top of the tube. The coke rests on the Gooch disc E. The bung also carries the electrodes L and L′ which connect to the detachable electric heater C. A Pyrex glass cover A encloses the whole. Air is led into the apparatus through K, down through the coke bed, and out through the tube M. The bung is protected from the heating effect of the hot waste gases by the tube H, the annular space between H and N being kept cool by the incoming air. The assembled apparatus is shown in fig. 2. The method of using this apparatus consists essentially in determining by "bracketing" the minimum air current in which the coke will continue to burn for more than 20 minutes after it has been lighted by means of the electrical heater C under standardized conditions. This minimum air current, which has in practically every case a critical value, has been termed the critical air blast (C.A.B.) of the coke, and it can be determined to within ± 0·003 c.ft. per min. For air blasts below the C.A.B. less than 10% of the coke is consumed before combustion ceases, whereas with air currents equal to or greater than the C.A.B., more than 50% of the coke is consumed. Some idea of the range and significance of the C.A.B. can be formed from Table I.

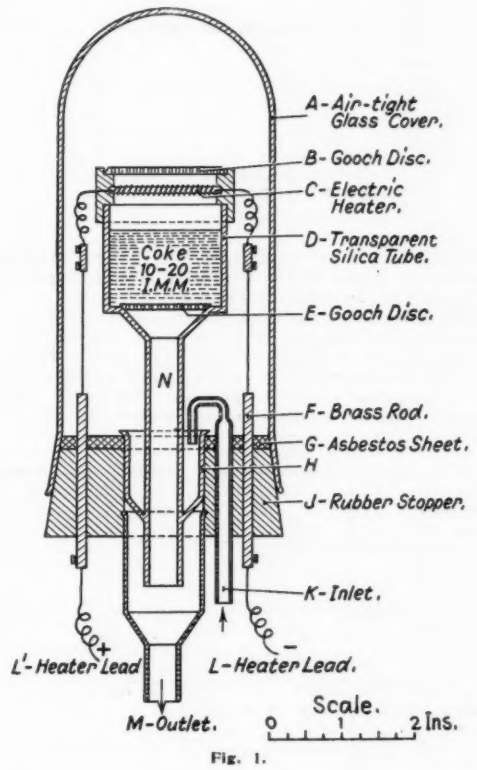


Fig. 1.

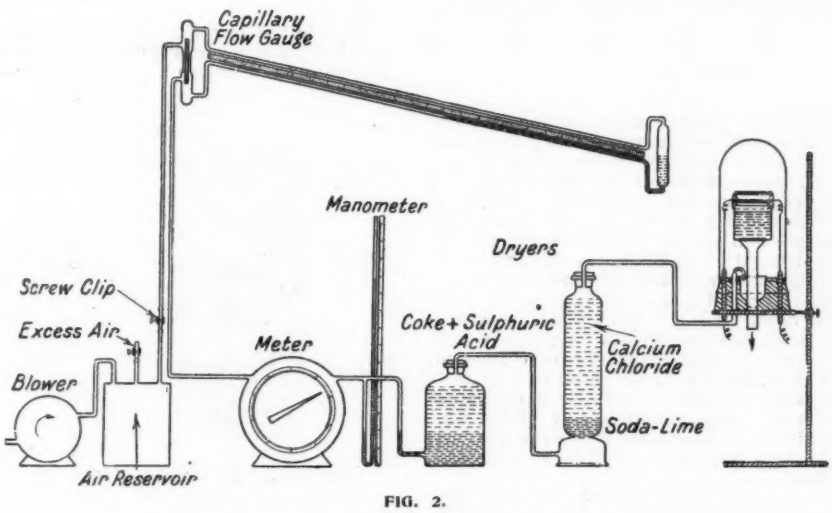


FIG. 2.

The results are typical of those obtained from the examination of a large number of cokes. It was necessary when studying the extreme types—viz., low-temperature and very unreactive high-temperature cokes—to modify slightly the standard method of ignition.

It will be seen from Table I. that low-temperature cokes have C.A.B.s in the range 0·015-0·030, special domestic,

* Paper before the Institute of Fuel, Jan. 10, 1934.

TABLE I.

Coke No.	Description.	% Ash.	Moisture %.	Vol. Matter, Less Moist. %	Fixed Carbon. %.	C.A.B., C.Ft./Min.	Average Ignition Time. Secs.
225	Low-temperature coke	5·1	3·4	9·2	82·3	0·015	60
205	" " "	4·6	3·3	7·3	84·8	0·029	..
216	" " "	5·2	1·9	23·1	69·8	0·018	40
281	Special high-temperature oven coke (experimental)	9·0	2·0	2·3	86·7	0·042	101
212	" " " " "	7·3	2·2	3·5	87·0	0·043	..
256	Domestic coke high temperature	4·6	3·2	2·1	90·1	0·047	140
255	" " "	5·5	2·7	3·1	88·7	0·048	89
248	Gas coke	7·8	3·2	2·6	86·4	0·045	91
G.3	"	13·2	1·4	2·0	83·4	0·055	180
207	"	7·9	1·4	1·3	89·4	0·065	..
208	"	6·3	1·1	1·9	90·7	0·073	..
218	High-temperature metallurgical coke	6·6	0·5	0·8	92·1	0·057	152
226	" " " "	9·0	0·5	0·9	89·6	0·059	153
236	" " " "	5·1	0·5	0·5	93·9	0·063	141
227	" " " "	5·6	0·3	0·9	93·2	0·073	175
211	" " " "	7·2	0·6	1·1	91·1	0·086	235
210	" " " "	8·5	0·5	1·6	89·4	0·096	209
30	" " " "	4·9	0·3	1·2	93·6	0·124	239
221	" " " "	6·8	0·3	0·8	92·1	> 0·10	285
..	Wood charcoal	1·4	4·7	21·2	72·7	0·009	..
233	Electrode graphite	0·6	0·2	0·6	98·6	0·117	257
232	Sponge from oven top	3·9	0·3	0·5	95·3	> 0·15	292

high-temperature oven cokes, in the range 0·042-0·048; gas cokes in the range 0·045-0·073; and metallurgical cokes in the range 0·057 > 0·150 c.ft./min.

Much more large-scale work remains to be done before any generalizations can be made with certainty as to the full significance of these results. It should be borne in mind that the suitability of a coke for a particular purpose can be governed largely by local conditions. However, certain preliminary experiments carried out under conditions which were considered normal indicated that in order to obtain a satisfactory coke fire in an ordinary open well grate a coke with a C.A.B. about 0·04 or less is necessary—*e.g.*, coke 281, C.A.B. 0·042 ignited readily and gave a very pleasant bright fire in an open well grate over a period of 15 hours. Cokes with C.A.B.s slightly greater than this, up to 0·050, have been found to burn satisfactorily in modified open grates. Cokes with C.A.B.s up to approximately 0·070 have given excellent service in small slow combustion stoves—*e.g.*, coke 226 (graded ½ in. to 1 in.), in five consecutive experiments in an " Ideal " No. 1 boiler, remained alight without any attention for periods varying from 11 to 20 hours, 60 to 90% of the charge being consumed; whereas coke 227, C.A.B. 0·073 c.ft. per min., in nine tests under similar conditions remained alight for a maximum time of only 8 to 9 hours, approximately 50% of the coke being consumed. It is known that some of the cokes having greater C.A.B.s than the above give satisfactory service in larger boilers and furnaces.

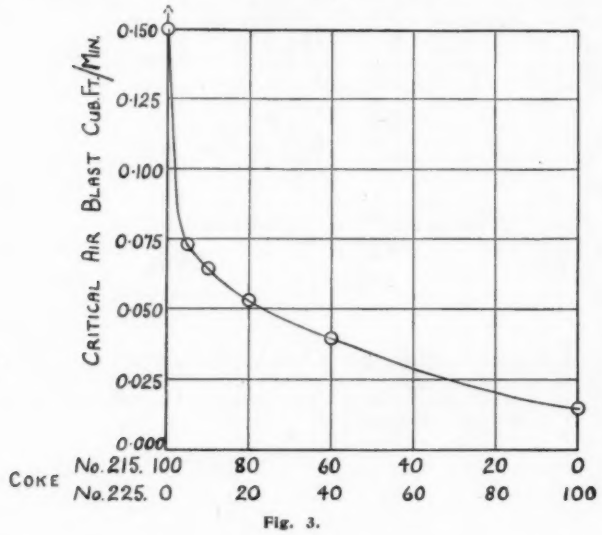


Fig. 3.

In assessing the suitability of a coke for a particular purpose from its C.A.B., it is important to bear in mind its heterogeneous nature. If some of the coke is very much less reactive than the rest, the more reactive part may burn away more rapidly than the rest, causing an accumulation of the unreactive coke in the fire bed. To test this point experiments have been carried out upon mixtures of reactive and unreactive cokes. Fig. 3 illustrates the results obtained employing mixtures (0 to 100%) of low-temperature (C.A.B. = 0·018 c.ft. per min.) and high-temperature (C.A.B. = 0·15 c.ft. per min.) cokes. It will be observed that small amounts of low-temperature coke depress considerably the C.A.B. of the unreactive coke. Open-fire tests were made employing a mixture of 75% metallurgical coke (C.A.B. = 0·097 c.ft. per min.) and 25% low-temperature coke (C.A.B. = 0·022 c.ft. per min.). The mixture had a C.A.B. of 0·044 c.ft. per min. In an open well grate, this mixture (graded ½ in. to 1 in. nuts) lighted readily with sticks and paper and gave a bright fire for only about two hours. It then became dull, and although no difficulty was experienced in keeping it alight it was very unsatisfactory.

It is therefore obvious that when a coke is examined by this test precautions should be taken to ensure that the sample does not contain an excessive amount of unreactive coke. This can be done by the examination of a sample composed of pieces selected from the bulk sample. The above example is, of course, an extreme case.

Variation of the Combustible Properties of Coke with Position in the Oven During Carbonization.

The conditions under which coal is carbonized vary to some extent, according to the position in the oven. It is therefore to be expected that variations in combustibility will occur even with coke from the same oven. In order to determine how this variation of carbonizing conditions affects the combustible properties (as determined by the C.A.B.) of the resulting coke, an examination has been made of the properties of coke from various parts of an oven.

The oven was a modern 18-in. top charged oven with a carbonizing time of 19 hours and flue temperatures of about 1170° C.

Sample 258 was a representative sample from the oven and was obtained from the bench after quenching according to practice. Prior to " pushing " the oven, a sample from the top of the oven was raked through the levelling hole in the door (ram side) and quenched in water. The oven door was then removed and another batch of coke raked from the top of the oven and quenched in the same way. These two lots were combined to form a sample of the top back section of the oven charge—Sample 259 (see fig. 4).

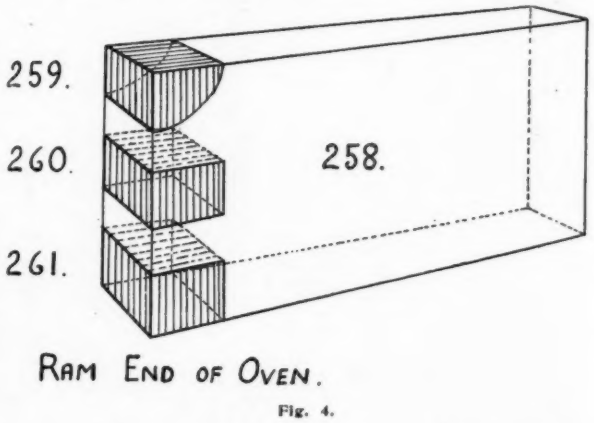


Fig. 4.

The oven was then " pushed," the last 4 ft. of the back

section of the charge being left in the coke guide and transferred, still in the guide, to the end of the bench and quenched as far as possible. The top of the section (about 3 ft. 6 in.) was pushed away, the middle 4 ft. of the section raked off, carefully quenched, and sampled. Sample 260 (see fig. 4).

A further quantity of coke was removed from the guide until a layer about 2 ft. high remained in the bottom. This was quenched and sampled. Sample 261 (see fig. 4). Samples 259, 260, and 261 represent sections of the oven shown in fig. 4—viz., the top, middle, and bottom portions of the back end of the oven charge. Sample 258 is representative of the whole of the oven charge.

centages show only small variations throughout. The less dense samples contain more moisture. This is particularly noticeable with 260 and 261, and may be due to some extent to the method of quenching. It is, however, significant that these samples show similar gradations in the percentage of volatile matter. The critical air blasts show a surprisingly large variation—viz., from 0·044 to 0·114 c.ft. per min. The inner sections (*i* samples) are in every case much more reactive than the outer sections (*o* samples), while the middle sections (*m* samples) are intermediate in character. The samples drawn from the back end of the oven, Nos. 259, 260, and 261, are decidedly more reactive than the corresponding average samples. It is significant

TABLE II.—*Screen Analyses.*

Coke No.	Through ½ In. %.	½–1 In. %.	1–1½ In. %.	1½–2 In. %.	2–3 In. %.	3–4 In. %.	On 4 In. %.	Over 3 In. %.	Under 1½ In. %.
258*o*	0·40	0·81	1·61	5·87	53·56	31·81	6·44	38·25	2·32
258*m*	0·55	0·41	1·08	6·11	55·18	32·08	4·59	36·67	2·04
258*i*	0·56	0·30	0·70	3·32	38·32	49·32	7·48	56·80	1·56

TABLE III—*Shatter Tests.*

Coke No.	Through ½ In. %.	½–1 In. %.	1–1½ In. %.	1½–2 In. %.	2–3 In. %.	3–4 In. %.	On 4 In. %.	Shatter Index.
258*o*	2·12	1·66	4·76	14·79	66·21	10·46	—	77/91
258*m*	1·71	1·84	3·38	7·91	64·33	20·00	0·83	85/93
258*i*	2·18	1·34	2·79	6·16	52·62	32·12	2·79	87/94

TABLE IV.—*Bulk Densities.*

Coke No.	Bulk Density, Lb./C.Ft.
258*o*	29·5
258*m*	28·4
258*i*	27·4

These four samples consisted of half-oven width pieces which were carefully sawn into three approximately equal pieces, representing the cauliflower ends, middle and inner parts of the half-width pieces. These were labelled *o* (outer, cauliflower sections from nearest the oven wall), *m* (middle) and *i* (inner) respectively—making 13 samples in all, viz., 258 (representative sample), 258*o*, 258*m*, and 258*i*; 259*o*, 259*m*, and 259*i*; 260*o*, 260*m*, 260*i*, and 261*o*, 261*m*, and 261*i*. The three 258 samples were sufficiently large—over 150 lbs. each—to permit of shatter tests being carried out.

that the No. 260 samples—*i.e.*, those from the middle of the back end of the oven—are more reactive than either the corresponding top or bottom coke.

It is apparent from Table V. that, although it is possible in many cases that the C.A.B. of a coke is to a large extent dependent upon the volatile matter content (*cf.* samples 260 and 261), this is not invariably so, as samples 258 and 259 have all approximately the same volatile matter content but widely differing C.A.B.s. There is a very close but not general parallelism between the C.A.B.s and the ignition times of the various samples.

The marked variation of the combustible properties of coke with its position in the oven during carbonization is clearly demonstrated by the above results. The separation of coke from the oven into reactive and less reactive fractions has certain possibilities, for it would lead to the production, at the same plant, of coke more suitable for specific purposes than the normal coke—*e.g.*, the reactive

TABLE V.—*Proximate Analyses and Results of Combustibility Tests.*

Coke. No.	Description.	Proximate Analysis.				Comb.	Test.
		Ash, %.	Moist. %.	Vol. Matter, Less Moist %.	Fixed Carbon, %.	C.A.B. C.Ft./Min.	Ignition Time, Secs.
258	Durham patent coke: representative sample	7·9	0·5	0·9	90·7	0·080*	218*
258*o*	258, outer ends	8·1	0·3	1·0	90·6	0·114*	229*
258*m*	258, middle	8·1	0·5	1·1	90·3	0·078	194
258*i*	258, inner ends	7·9	0·7	1·0	90·4	0·061	173
259*o*	Top coke, outer ends	8·3	0·4	0·9	90·4	0·090	210
259*m*	,, ,, middle	8·8	0·7	0·9	89·6	0·071	187
259*i*	,, ,, inner ends	8·1	0·6	0·8	90·5	0·063 0·067	181
260*o*	Middle coke, outer ends	8·0	0·9	0·7	90·4	0·063	181
260*m*	,, ,, middle	7·9	1·9	1·8	88·4	0·054	154
260*i*	,, ,, inner ends	8·0	3·0	3·0	86·0	0·044	114
261*o*	Bottom coke, outer ends	8·8	0·6	1·0	89·6	0·074	190
261*m*	,, ,, middle	8·4	1·3	1·4	88·9	0·060	165
261*i*	,, ,, inner ends	8·2	2·6	2·5	86·7	0·047	128

* Approximate.

The screen analyses, shatter indices, and bulk densities of the three sections, wall ends, middle pieces, and inner ends, of the representative sample 258 are shown in Tables II., III., and IV. The inner ends, although of less bulk density, are decidedly more resistant to shatter than the more dense wall ends of the half-width pieces. The middle sections show intermediate properties.

Table IV. gives the proximate analyses and the results of the combustibility tests of all 13 samples. The ash per-

fractions would provide good open fire and closed stove fuel, whereas the less reactive coke might prove more suitable for larger stoves and furnaces. Whether or not the unreactive fractions would make better metallurgical coke only further experiments can show. It is obvious, however, from the above, that there is a decided need for the strict control of the combustible properties of coke, particularly if the coke is destined for the domestic market.

In conclusion, the authors desire to record their thanks

to the Northern Coke Research Committee, Armstrong College, Newcastle-upon-Tyne, for permission to publish these results.

Discussion.

The CHAIRMAN (Dr. E. W. Smith, C.B.E.) said the method described in the paper had been tried out over quite a long period, and had proved extraordinarily interesting in differentiating between different classes of coke. Dr. Riley would probably agree that it was the first test that should be carried out, and that the second test should be a grate test; the method would not necessarily differentiate between fuels, as regards their application in the domestic grate, sufficiently closely to give a final determination, but in the laboratory it was capable of differentiating between the ultimate structures of the fuels and the ultimate size of fuel in a very happy way. The authors had been candid in acknowledging the limitations of the method, but there were possibilities in it which should not be left where they were. If equipment such as this could be made to satisfy the various ideas of those interested in the testing of the combustibility of coke, there was no doubt that it would be of great advantage to have a standard equipment which could be used in the laboratory for comparing fuels from different sources.

His personal feeling was that two quite distinct types of domestic coke were required. The first was one which could be used entirely satisfactorily in the open fire—not a specially installed open fire, but a good type of modern open fire, with semi-well grate or something similar. The characteristics of that type of fuel were quite different from the characteristics of the second type—*i.e.*, that which should be used in the closed stove. In the first case one could have a material of comparatively light bulk density, open, and so on; in the second case he believed it was essential that the material should approximate as closely as possible to what might be termed an "artificial anthracite." Many of these lighter materials, however combustible they were, would not be entirely satisfactory in a closed stove unless they approximated in density and in strength to an artificial anthracite. He had been particularly impressed by that fact during the last few weeks, when studying requirements on the Continent. Although it was often said that Continental requirements did not apply in this country, he emphasized that in respect of fuel for the closed stove the requirements there and here were the same; and he was afraid the people on the Continent knew more about what they wanted, and insisted more upon what they wanted, than was the case here. He knew of substantial interests who were quite prepared to build plants, at considerable expense, if only they could get the plants which would produce this so-called artificial anthracite. It was not merely a question of carbonizing; it was also a matter of blending, proper selection of the coal, and so on.

As had been shown in the paper, a low-temperature coke was too good for the closed stove; he believed it was wasteful to use low-temperature coke in the closed stove, and that they would have to develop two techniques side by side and supply two separate and distinct markets.

It would be interesting to explore further the reasons why Welsh and Scottish high-temperature cokes appeared to be more reactive, when carbonized presumably under the same conditions, than, say, Durham cokes. That phenomenon had been noted in the Gas Industry, and it appeared to him that it might bear some relation to the heat requirements of carbonization. If the heat input of a coke oven were the same per hour, the Welsh coal was burned off to a given state of completion in a shorter time than the Durham coal; alternatively, an 18-hour charge of a Welsh or Scottish coal in the oven required less B.Th.U. to carbonize it than was the case with a Durham or Yorkshire coal.

VOLATILE CONTENTS.

Mr. P. C. POPE (Secretary of the Institute) asked about the volatile contents of the coals.

The CHAIRMAN replied that there was a difference in the volatile contents, that of the Scottish and Welsh coals being less, but he did not think that that factor provided necessarily the whole explanation. He suggested that, irrespective of volatile content, the Scottish and Welsh coals were nearer to the non-coking coals than were the coals of Durham and Yorkshire, and he believed that the greater the percentage of properly incorporated non-coking coals in a blend, the better would be the result obtained in the equipment described in the paper.

Discussing long-period tests on coke from the same ovens, Dr. Smith said it would not do to standardize or to form broad conclusions from tests on one particular oven, because there might be very big differences in the same oven from day to day, depending on the temporary conditions. Slight differences in draughts, atmospheric conditions, and so on, materially altered the distribution of the heat in the oven; further, some ovens were notoriously badly heated at the top and some at the bottom. That point was important in deducing information from tests.

Mr. JOHN ROBERTS said it was rather striking that one could obtain cokes with C.A.B. values very much alike from two different classes of coal. But he did not think the same explanation would apply to both coals. Scottish coals, from the coking standpoint, were less mature than a Durham coking coal, and those less mature coals had feebler coking properties. In Wales, metallurgical cokes were made either from a coal which was more mature than a Durham coking coal or from a mixture of that Welsh coking coal with a still more mature Welsh coal. In both cases there was comparatively rapid heat penetration. Welsh coals could be coked in about 80% of the time required for coking Yorkshire coal. The reason was the less pronounced plastic layer in the Welsh coals as used; they were generally blended, though not always scientifically. On the other hand, the Scottish coals, which were feebly coking, gave rapid heat penetration, for they also had not a very pronounced plastic layer. But the coke made from an immature coal was more reactive to air than was the coke made from a more mature coal such as the Durham coal, so that a different explanation would be required for both cases.

It seemed to be necessary to establish a relationship between the C.A.B. value and the ignition time; it was important to have rapid ignition as well as low C.A.B. value. The experimental work described in the paper indicated that those who were out to make a reactive coke, whether at high, low, or medium temperatures, were working in the right direction, because it was shown that by reducing the coking time with a proper blend—that was the only factor which enabled one to do it satisfactorily—one could get coke having very low C.A.B. values.

Dr. J. G. KING (H.M. Fuel Research Station) commented that the method described was most compact, and, once the apparatus was set up, it gave results with considerable facility and speed. It seemed that the C.A.B. value must bear some relationship to ignition temperature. Again, when dealing with a mixed coke, such as a mixture of high-temperature and low-temperature coke, it must be borne in mind that the low-temperature coke had an ignition temperature in the neighbourhood of 220° C., whereas the ignition temperature of the high-temperature coke was more like 450° C. One would expect, under the conditions applied by the authors, that if there were sufficient low-temperature coke present the mixture would show the C.A.B. value of low-temperature coke—assuming that the high-temperature coke present was not taking up an undue amount of heat. That was shown to some extent in the results given, where the addition of a small percentage of low-temperature coke made a large difference to the C.A.B. value. It seemed that the C.A.B. figure for a mixed coke was a compromise, and was not the average figure for the coke. It was important to bear in mind this aspect of C.A.B. value when considering cokes made at intermediate temperatures, where, in order to coke the centre of the charge completely, the outer part must be somewhat overheated. The centre part of such a coke possessed the properties of low-temperature coke, whereas the outer part had properties approaching those of high-temperature coke.

Some experimental work was being done in a Woodall-Duckham chamber oven at the Fuel Research Station, where it was intended to examine the effect of blending coking coal, non-coking coal, and breeze in all sorts of proportions. He was not yet prepared to give figures, but it could be said that if non-coking coal were added in a blend to a coking coal, the combustibility of the coke produced was increased steadily with the proportion of non-coking coal. If that non-coking coal were replaced by coke breeze, the effect of each 1% of breeze was greater than the effect of each 1% of non-coking coal; that was true up to a content of about 20% of breeze. If the non-coking coal constituent were replaced by finely-divided breeze, the final coke was more reactive. It was a low-temperature breeze.

A series of carbonizing experiments was also being made in a Glover-West retort on different types of coal—strongly coking and medium-coking Yorkshire coals, and a less strongly coking coal from a Northumberland area. It was found that, although the cokes were produced at high temperatures, their reactivities varied. The coke produced from the slightly-coking Northumberland coal was almost as reactive as a low-temperature coke produced at a temperature of 360° C. It ignited and burned almost as well in an open fire.

EFFECT OF INCREASED DRAUGHT.

Dr. W. R. ORMANDY pointed out that the results obtained by the instrument described were not always commensurate with the results obtained from the same fuels tested in an open grate. He suggested that it would be of real benefit if the authors used the standard open grate and the standard open grate system of testing which had been worked out at the Fuel Research Board. The essential discovery in the work described by the authors was that a coke which, with a certain draught, would not burn, could be made to burn if the draught were slightly increased, the other conditions remaining the same. That pointed to an explanation as to why one coke would burn in a certain open grate with a certain draught, and another coke, varying very slightly, but just sufficiently far from the critical value, behaved entirely differently. When curves were exhibited representing the reactivity of mixtures of easily-ignitable and difficultly-ignitable cokes, he had thought that something of real practical value had been discovered—*i.e.*, that if a small amount of easily-burnable coke were added there could be burned with it three or four times its weight of coke which was not easily burnable. Then Dr. Riley had removed that bright picture by stating that, although it would do so in the machine described, it would not do so where it was wanted to.

Mr. E. C. EVANS (an Hon. Secretary of the Institute), discussing the factors involved in the C.A.B. and ignition values—two of which were volatile matter and structure—said he would be glad if the authors would also consider the characteristics of the ash. If they could not give the analysis of the ash, they might indicate the colour and say whether it contained iron oxide or any of those catalysts which influenced reactivity.

Dr. F. R. WESTON (Gas Light and Coke Company) said that for about two months he had been using, in the Gas Light and Coke Company's laboratory, the apparatus described in the paper, which in principle was rather similar to a large-scale test apparatus which had been used for a number of years. The latter gave very useful information as to the properties required in cokes, and if the apparatus described in the paper would give similar information the authors were to be congratulated on having produced an apparatus which was far neater and which gave results more quickly, while it required only a very small sample of coke.

So far he had concentrated on a few cokes which were representative of those likely to be produced normally in the Gas Industry—not special blends—and in some cases there had been difficulty in getting concordant results. In one case an air rate of 0·088 c.ft. per minute was not sufficient to keep the coke alight for more than 12 minutes, whereas in subsequent experiments 0·083 c.ft. per minute left only 24% residue. The experimenters were not sure whether this was due to the sample being non-homogeneous, or to slight fluctuations in the heater current giving different ignition effects. In the cokes tested so far the limits of the critical air blasts lay between 0·068 and 0·083 c.ft. per minute, so that it was necessary to be able to determine the actual value very closely in order to differentiate between specimens which embraced the closed stove cokes and open grate cokes.

The authors of the paper had tested mixtures of low-temperature and high-temperature cokes for the open grate in sizes from ½ to 1 in., which appeared to be rather small; he usually reckoned that the size should be from 1 to 2 in. at least.

EXPERIMENTS WITH GRAPHITE.

Mr. J. F. RONCA, O.B.E. (Director of Gas Administration, Board of Trade), asked if the authors had experimented with pure graphite.

Dr. G. E. FOXWELL, commenting on an experiment made by the authors in which a mixture of low-temperature and high-temperature coke did not continue to burn, said that he had made in coke ovens a material consisting of fairly high volatile low-temperature coke on the inside and high-temperature coke on the outside; when this was broken up and burned in the open grate it had made a glorious fire, which was maintained for a very long time, and it had burned completely.

It seemed to him that the experimental method described in the paper, and all such methods, merely investigated the materials manufactured; they did not actually investigate the materials one sold. One investigated the combustible and burning properties of a portion of a carbonized fuel, and those who had made experiments on the grate knew that there was a tremendous number of factors not included in that. He would like to see some of the coke research committees investigate all the physical and chemical factors involved in burning in an open grate cokes made at medium or high temperatures. One could not help thinking that they then would not want low-temperature carbonization at all.

Mr. N. E. SIDERFIN (Gas Light and Coke Company) said the experience of the Company confirmed that cokes which burned satisfactorily in the open fireplace and lit up with an ease which compared well with that of ordinary coal or low-temperature fuels could be made by blending non-coking and coking coals, or suitably prepared semi-coke and coking coals. Their volatile content could be reduced by high-temperature methods to 2%, and they would burn quite as satisfactorily as some of the low-temperature cokes. They did not ignite or burn quite so rapidly in the grate, but after examining quite a lot of these fuels the Company was of opinion that fires made with cokes of this description were generally more satisfactory, because they were less wasteful. The fuel was easily lighted with the ordinary quantity of paper and sticks.

The fact that in some of the samples referred to in the paper the volatile contents varied by not more than 0·1%, whereas the C.A.B. values varied considerably, emphasized the effect of temperature upon the quality of the coke. But so far as the future was concerned, he felt sure that if carbonizing methods which, while truly high-temperature methods, could be developed so as to minimize the temperature in the charge in the oven or retort, it was highly probable that we should be able to make a thoroughly satisfactory domestic smokeless fuel by high-temperature methods from blends, and by using temperature control.

As to the effect of plastic zone on the rate of heat penetration, he said the Company had found that the rate of heat penetration could be the same whether or not there was a plastic zone. It had taken longer to carbonize to a certain volatile content certain positively non-coking coals in which it was impossible to conceive that a plastic zone existed than it had to carbonize an ordinary Durham gas coal to that volatile content.

READIER IGNITABILITY OF MOIST COKE.

Dr. G. W. ANDERSON referred to the moisture content of the coke samples, because when the coke was dried at 120° C. some changes seemed to take place, and, in fact, when about ½% of moisture was left in the coke it would ignite more readily and burn more readily than perfectly dry coke. He suggested that the authors should investigate this important aspect further, for it had not been emphasized sufficiently and was not realized generally. He suggested that both Mr. Siderfin and Dr. Riley had over-emphasized the volatile matter remaining in a coke after carbonization. The volatile content might affect the ignition point, and that was very important, but it did not affect the combustibility. A London Gas Company with which he was associated some years ago had developed in the laboratory a test not dissimilar from that developed by the authors of the paper, except that the air blast was maintained constant and the rate of progress of combustion was measured. That rate, for various cokes produced under more or less the same conditions, became a linear function of the volatile matter, and, of course, inferred that the volatile content was of primary importance in determining the combustibility of the coke. But he had concluded that this was a fallacious deduction, and that the factor affecting the combustibility was the surface and the pores rather than volatile content. He believed the producers of these cokes still held the opinion that more volatile matter than was customary should be left in them, hoping thereby to produce an ideal combustible fuel for the public; but he considered that that was a mistake, and that the stress should be laid on pore surface, which could be achieved by other means.

Finally, Dr. Anderson asked whether the coke size of 10-20 I.M.M., adopted by the authors, was chosen arbitrarily, or because investigations had shown that most consistent results were obtained with that grading. The influence of varying grade should be determined.

The CHAIRMAN emphasized the important point made by Mr. Siderfin, that the Gas Industry should be able to produce, at high temperatures, the material that was required. He personally had no doubt about that. In one room at his own house he used a low-temperature fuel when the fire was first lit, and, after the fire was going well, it was quite common to use only high-temperature coke on that fire for the rest of the day. The only defects of the particular high-temperature coke were that it was difficult to ignite and that there might be more left in the grate in the evening; but in the intervening period there was a perfectly satisfactory state of development and radiation, a better form of radiation, in his view, than that from low-temperature fuel. It was pleasant, but one did hear the coke roll over itself as it was burning. In the absence of proper coal cleaning, such as obtained more in the coking industry, and in the absence of correct quenching, there was noisiness and spitting. That could be obviated, however, by a change of technique which was so simple that, if gas engineers and the coking people only realized it, they would adopt at once. But it was not realized, and therefore was not adopted.

REACTIVITY OF COKES.

Dr. RILEY, replying to the Chairman's early remarks, said he would not like to convey the impression that Durham cokes were, generally speaking, less reactive than Scottish and Welsh cokes. The Northern Coke Research Association was a Durham Association, and had examined far more Durham cokes than others. They had examined only about three Welsh cokes, but whether they could generalize from the results on them he could not say. They had also examined a number of Yorkshire domestic cokes, which, generally speaking, were extremely reactive.

Replying to Dr. King, he said he did not think that C.A.B. altogether measured ignition temperature, although it had a lot to do with it. The C.A.B. values did not always follow in the same order as ignition time; the ignition time gave a guide as to what the C.A.B. would be, but there were discrepancies. It measured a factor which included that, and something else besides, but he would not like to say what.

Experiments had been made on the effect of varying the size of coke used in the tests, and the size did, of course, affect the results. Following the practice of some other workers, he had tried a size of 5-10 I.M.M. in his apparatus, but found that coke of that size did not ignite evenly, and the size was reduced to 10-20 I.M.M., which gave much better ignition conditions. He hoped that quite a number of people would use the apparatus and that their combined experience would lead to standardization. The Midland and the Northern Coke Research Committees, using apparatus very similar but not quite the same, could reproduce each other's results for C.A.B. to within 0·003 c.ft. per minute; and when different investigators used the apparatus in the Northern Committee's laboratory they obtained the same results.

Undried coke was rather more combustible than dried coke, the C.A.B. value of the undried coke being from 0·002 to 0·003 lower. That confirmed Dr. Anderson's statement. The ash constitution had a very definite effect on the results. The apparatus resulted in reducing the time required for testing, as compared with grate tests. In an ordinary working day one could test four cokes, but one could not do that in a grate.

Dr. KING said that one test per day could be made in a grate.

Dr. RILEY, dealing with catalytic action, said some experiments were made on the problem of sulphur pick-up in the cupola, and the result of the addition of between 1 and 2% of lime to the fuel was definitely to lower the C.A.B. quite considerably. In the case of a patent oven coke it was lowered from 0·08 to 0·06.

Differences in results might be accounted for by the variation of the energy put into the heating element; at one period certain discrepancies were noted, but if the same amount of energy was put into the heating element each time there was no difficulty in reproducing results. He had used simply an ammeter and a voltmeter. In some cases the resistance of the elements varied by as much as 10%.

He had not made experiments with pure graphite.

The Position of Gas-Works Bye-Products in Australia*

By R. S. Andrews, B.Sc., A.M.I.Chem.E., Melbourne.

During the past two decades, the consumption of gas has greatly increased, and extra plant has been installed to meet this additional demand, regardless of the quantity of bye-products that would be forthcoming in consequence.

This position has been further aggravated by a change in the system of carbonizing, in which the tar yield has been increased by 50%, accompanied by a corresponding reduction in quality.

Fuel oil, and in Victoria brown coal briquettes, have made serious inroads into the coke market, and the recovery of ammonia as sulphate has been rendered almost profitless by the importation of cheap synthetic ammonium sulphate from abroad. Thus it would appear that the production and recovery of bye-products within the Gas Industry has reached a stage when every phase of the problem needs careful consideration.

This problem should be considered not only in the present, but with a thought to the future, and the nature of the developments that are likely to take place in gas production.

Coke.

The quality of the coke will vary to a large extent with the constitution of the coal, but in the Gas Industry in Australia, little difficulty is experienced in exercising a choice of coal. The one that is used wherever practicable is from the Greta Series on the Maitland field in New South Wales, and it has been classed as the world's best gas-making coal. It differs from those in Britain and the United States in being younger (permo-carboniferous) and richer in volatile matter; its coking properties, as would be expected, are not as good, the coke being more friable with a tendency to crush under weight, resulting in the production of a large percentage of breeze. There is a marked difference not only in the properties of the coke from coals of different constitution, but also in the properties of the coke from the same coal when carbonized in different systems. In cases where both continuous and intermittent systems are employed, it would appear advisable to keep the respective cokes separate and dispose of them in the avenues to which each is most suited.

The relative proportion of breeze produced depends on the nature of the coal, the systems of carbonizing, the extent of steaming, and the amount of handling the coke is subjected to after extraction. The quantity produced from Maitland coal would be between 10% and 20% of the total coke. Undoubtedly, the correct use for breeze is for steam raising, preferably under the works boilers. Most works engineers are reluctant to use breeze if they can find someone else willing to do so, even for a very moderate price. This is mainly due to the fact that they have not the correct grates for the purpose.

This question has been investigated extensively by the Broken Hill Prop. Company, Australian Gaslight Company, and Manly Gas Company. In each case special coke breeze grates are being used.

The best test obtained resulted in an efficiency of 62%, the ash content of the breeze being only 21%, the moisture content 13%. With gas-works breeze containing only 10% of ash and 8% moisture, good efficiencies are obtainable, the Australian Gaslight Company having obtained efficiencies up to 75%.

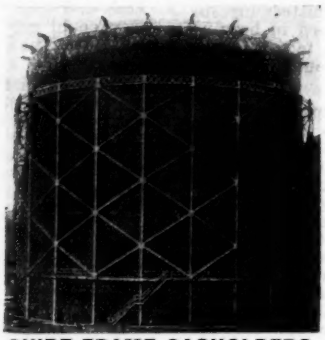
During the past few years the sale of coke has been subjected to severe competition from fuel oil, and, in Victoria, brown coal briquettes.

The market for the large percentage of coke now sold for steam raising is largely held on sufferance. Manufacturers in the city are obliged to eliminate smoke, which largely prohibits the use of bituminous coal, and rather than alter existing plant for briquettes or oil, coke is used. At present, there is a large margin between the landed and selling price of fuel oil, and should this be reduced the sale of coke for this purpose would be uncertain.

The domestic market for coke is by no means assured;

*From a paper before the Seventh Convention of the Australian Gas Institute.

SPIRAL GASHOLDERS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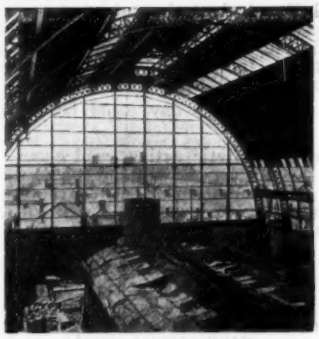
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PURIFIERS

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the barbarous habit of burning coke in the grate of a modern lounge room is being replaced by the cleaner and more elegant methods of housewarming.

In foundries, oil and gas are replacing coke owing to their increased efficiency and ease of control, which is essential to modern foundry practice. While this position at times presents serious difficulties, it is not a case for undue alarm. The situation is being met by the installation of water gas plants, regulating the price and quantity of coke available for sale. The heat units are more profitable in the form of gas than in the form of coke. The position then appears to be that the coke market is bound to dwindle under competition from cleaner and more easily controlled fuels. The price and quantity of coke available for market will be regulated by additional water gas units resulting in cheaper gas, and the realization that coke is more valuable in the form of gas than coke. The cost of water gas per therm is only three-quarters that of coal gas, so that the cheaper gas would permit this fuel to enter the industrial field to a better advantage and become a competitor of fuel oil in many avenues from which it is at present debarred. The position of the coke market in Victoria would be deplorable if the Metropolitan Gas Company had not installed the water gas plant in 1929 and taken 50,000 tons a year from the available coke for sale. I venture to say that the position in Sydney would have been even worse owing to the erection of the Harbour Bridge, and the cessation of coke consuming ferry traffic, had not the Australian Gaslight Company installed their large water gas plant.

The small country works are continually finding it to their advantage to mix producer gas with their coal gas, in order to reduce the calorific value to 500 B.Th.U. and to obtain a larger gas yield per ton of coal. In other words, they are finding that coke is more valuable in the form of gas.

These tendencies are merely "coming events casting their shadows before."

Results of four typical works within the Commonwealth show that there is an economical limit to steaming in continuous verticals, and that, when possible, the correct place for production of water gas is in a water gas generator and not in a retort. They also demonstrate that coke is more valuable in the form of gas.

Therms in water gas cost less than therms in coal gas.

The small country works may argue that the price they obtain for coke is greatly in excess of that obtained in the cities, and that it would pay them better to sell their coke as coke. This, however, is offset by the higher price they are forced to pay for their coal.

Thus coke is a most valuable bye-product in the form of gas.

Ammonia.

The sulphate position is anything but encouraging, and it is difficult to suggest definite plans for improvement. Two suggestions, however, may be offered:

(1) Decreasing of labour costs by abolition of hand-fished saturators.

(2) The production of cheaper acid.

The market for ammonium chloride in Australia is limited, only 300-500 tons being consumed annually; thus there is little scope for ammonia disposal in this direction.

The present solution would appear to be to give the utmost encouragement to those companies who have had sufficient foresight and fortune to produce ammonia in other forms than sulphate, by supplying them with concentrated ammonia liquor at more reasonable rates, provided their consumption exceeded a specified amount. This would permit them to extend the market of gaseous ammonia for refrigeration purposes, which should not be impossible in a climate such as Australia and its surrounding countries possess.

Extensive research is being carried out at present in departments of agriculture relating to the use of ammonium polysulphide as an insecticide. The Metropolitan Gas Company has supplied this product for investigation purposes. The results have been encouraging, and a process has been developed using the sulphur from spent oxide, and the concentrated ammonia liquor, by which this product can be produced for less than one-quarter of the cost of its present market price. This opens up a fresh possibility for profitable ammonia recovery. With increased use of water gas in town gas supply the ammonia production will decrease, and less will be available for sulphate manufacture. This also brings forth the question as to the possibility of the Gas Industry in this country entering the field of synthetic ammonia production, with its cheap available hydrogen obtained from blue water gas.

(To be continued.)

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Length (effective)	4 yards
Weight	1 cwt.
Coating	Coated both sides, outside only, or uncoated

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THE STANTON IRONWORKS COMPANY LIMITED, Near NOTTINGHAM

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

Stock Exchange affairs last week were mainly dominated by Foreign Exchange movements arising out of President Roosevelt's latest message to Congress. The immediate effect was a substantial advance in gold-mining shares on the higher price of the commodity, and business was diverted to this section from the gilt-edged and industrial groups where prices became somewhat irregular. Home rails were well supported on the latest good traffic returns, and rubber shares also had a large following.

The weakness which was noticeable in other high-class investment stocks did not extend to the Gas Market, where a considerable volume of business was recorded and several further upward price movements occurred. Inquiries for Hornsey consolidated led to a sharp rise of 10 to 132½, and at this price the yield, on the basis of a 6% dividend, is still a trifle over 4½%. British 7% preference advanced 6 to 153½, business being recorded at 155; Montevideo rose 5 to 60; while Mid-Southern Utility 4% preference and Portsmouth 4% consolidated both gained 3 to 97½ and 167½ respectively. Among several smaller increases were included South Metropolitan and Wandsworth ordinary stocks with gains of 1 point each, and, on the local Exchange, Newcastle units hardened 3d. to 26s. 3d.

At the time of writing there are more ordinary stocks available than usual, and the current prices of those on offer, several of which are shown in the following table, include four months of the final or half-yearly dividend:

Amount Offered.	——	Dividend 1932.	Price.	Yield.
£				£ s. d.
1,180	Commercial	5⅞	126	4 11 3
10,000	Gas Light units	£5 12s	278. 3d.	4 2 2
1,010	Guildford	7½	167	4 9 9
500	Hartlepool Gas and Water	5	113	4 8 6
1,000	Liverpool	6	133	4 10 2
200	Preston "B"	7	140	5 0 0
1,500	South Metropolitan	6.	137	4 7 7
1,192	Swansea	5	111	4 10 0
1,374	Swindon	5½	118½	4 12 10
364	Wellington (Salop)	7	148	4 14 7

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Jan.* 22.

There are very few changes to report in the tar products market, and current prices are as follows:

Pitch is about 62s. 6d. per ton f.o.b.

Creosote, 3d. to 3¼d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, about 3s.; pure benzole, 1s. 10d. to 1s. 11d.; 95/160 solvent naphtha, about 1s. 9d.; and 90/140 pyridine bases, 5s. 6d. to 5s. 9d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Jan. 22.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s. Pitch—East Coast, 60s. to 62s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 60s. to 62s. 6d.* Toluole, naked, North, 2s. 5d. to 2s. 7d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 6¼d. to 1s. 7¼d. Heavy naphtha, North, 10½d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2½d. to 2¾d.; low gravity, 2d. to 2½d.; Scotland, 2½d. to 2¾d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 2s. 1¼d. to 2s. 2½d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Jan.* 20.

Business in many products continues difficult for want of prompt supplies. On the whole, prices are steady with inquiries more numerous.

Crude gas-works tar.—With pitch still weak value is probably not now more than 36s. to 38s. per ton *ex* works.

Pitch.—Business continues difficult and value is nominal at 55s. to 57s. 6d. per ton f.o.b. Glasgow for export and about 55s. per ton *ex* works in bulk for home trade.

Refined tar is commanding a little more attention with value at 3¼d. to 3⅜d. per gallon f.o.r. in buyers' packages.

Creosote oil.—There is a good demand for available supplies and prices are therefore steady. B.E.S.A. specification is 4d. to 4¼d. per gallon; low gravity, 4d. to 4¼d. per gallon; and neutral oil, 4d. to 4¼d. per gallon—all in bulk *ex* works.

Cresylic acid.—There is very little being offered in this district, and quotations are therefore steady. Pale, 97/99%, is 1s. 1d. to 1s. 2d. per gallon; dark, 97/99%, 11d. to 1s. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha.—Production is low and available supplies command, without difficulty, 4½d. to 5d. per gallon according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 6d. to 1s. 7d. per gallon, and 90/190 quality is 1s. per gallon.

Motor benzole continues scarce at 1s. 7d. per gallon *ex* works.

Pyridines.—90/160 grade is 4s. to 4s. 3d. per gallon, and 90/140 grade is 4s. 6d. to 5s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 10	to	0 10¼	per gallon at works
Motor ,,	1 5	,,	1 5½	,, ,, ,,
90% ,,	1 5½	,,	1 6	,, ,, ,,
Pure ,,	1 8½	,,	1 9	,, ,, ,,

Contracts Advertised To-Day.

Compressor.
Newbury Corporation. [p. 212.]

District Governor.
Newbury Corporation. [p. 212.]

Gasholder, Tank, and Foundation.
Newcastle-under-Lyme Gas Department. [p. 212.]

Pipes (Various) and Specials.
Newbury Corporation. [p. 212.]

Stores (Tar, Pitch, Creosote Oil, &c.).
Nottingham Corporation. [p. 212.]

Tar.
Slough Gas and Coke Company. [p. 212.]

Washer and Condenser.
Newbury Corporation. [p. 212.]

New Capital Issues.

Knottingley Gas Company.—As will be seen from our advertisement columns, Messrs. A. & W. Richards are offering for sale by tender 6000 £1 5% preference shares in this Company at a minimum price of issue of £1 per share. Tenders must be received not later than 11 a.m. on Tuesday, Feb. 6.

This Model Coin Collector

Was *supplied* in 1901

And is *still* in use

Telephones:
MANCHESTER: 2289 COLLYHURST
NOTTINGHAM: 75202
WATFORD 2645

Telegrams:
SAWER, MANCHESTER
SAWER, NOTTINGHAM
2645, WATFORD

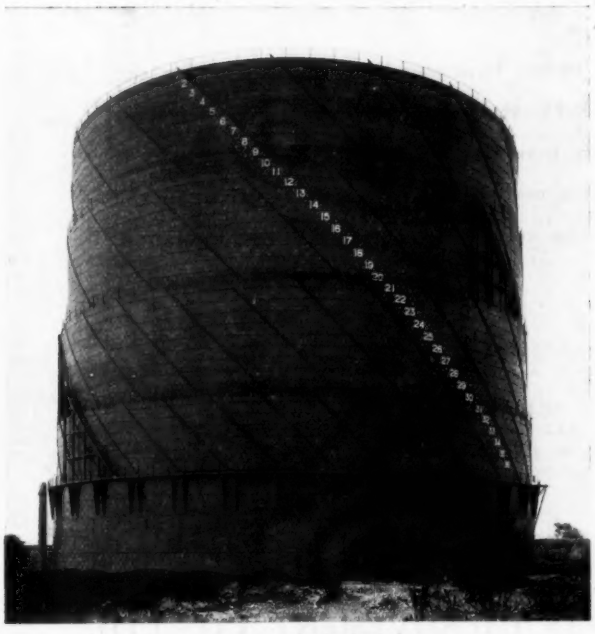
Quality Tells

SOLE MAKERS: **SAWER & PURVES**
(BRANCH OF METERS LTD.)

NELSON METER WORKS
MANCHESTER 10

DERBY ROAD
WATFORD

RADFORD METER WORKS
NOTTINGHAM



AT WOLVERHAMPTON
CAPACITY, 3 MILLION CUBIC FEET

C. & W. WALKER

LIMITED
DONNINGTON
Nr. WELLINGTON
—SHROPSHIRE

SPIRAL GASHOLDERS

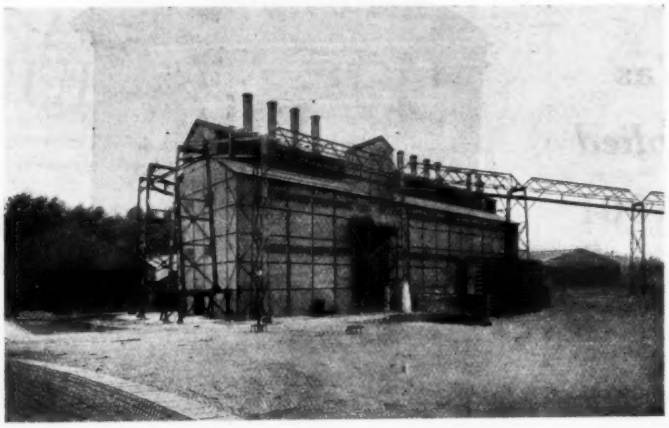
BRITISH MATERIALS
BRITISH LABOUR
HIGHEST QUALITY
IN
WORKMANSHIP

70 YEARS EXPERIENCE

MILBOURNE SELF-LUBRICATING ROLLER CARRIAGES

LONDON OFFICE — 70, VICTORIA STREET, WESTMINSTER, S.W.1

★



Another Repeat Order for Glover-West Verticals...

THE carbonizing plant illustrated comprises two installations of Glover-West continuous vertical retorts at the Belgrave Gate Works of the Leicester Corporation Gas Department. The first was a 2½-million plant of 80 retorts, built in 1914. A further 1¼-million unit of 32 retorts was added in 1921. The present order entails the modernization of half the original plant, incorporating new model steaming retorts and giving an increase in daily capacity of more than a million cubic feet.

Three large orders have also been undertaken for the Aylestone Road Gasworks at Leicester, where Glover-West plant of more than 8 million cubic feet daily capacity is installed. This new order is therefore the sixth, or the fifth repeat order, received from the Leicester Corporation.

Prompt and expert attention is given to all enquiries relating to the modern and improved carbonizing and fuel-handling systems to which our whole resources are devoted.

★ OUT OF MORE THAN 350 GLOVER-WEST PLANTS INSTALLED THROUGHOUT THE WORLD, NO LESS THAN 148 HAVE BEEN "REPEAT ORDERS" FOR EXTENSIONS TO PLANTS PREVIOUSLY INSTALLED BY US.

WEST'S GAS IMPROVEMENT CO., LTD.
MILES PLATTING, MANCHESTER, 10

TELEPHONE: COLLYHURST 2961 (4 lines). TELEGRAMS: STOKER, MANCHESTER

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Jan. 20. (Provincial Exchanges Jan. 19.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Oct. 9	7	7	Alliance & Dublin Ord. ...	122—132	...	130½—131½
374,000	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	90—100*	...	...
557,655	"	Aug. 28	7	7	Barnet Ord. 7 p.c.	167—172	...	...
300,000	1	Oct. 23	1/9‡	1/4‡	Bombay, Ltd.	26/—28/-	...	27/3—27/6
178,280	Stk.	Aug. 14	9½	9½	Bournemouth sliding scale	195—205	...	...
550,050	"	"	7	7	Do. 7 p.c. max. ...	163—168	...	...
439,160	"	"	6	6	Do. 6 p.c. Pref ...	138—143	...	...
50,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
162,025	"	"	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
210,000	"	"	5	5	Do. 5 p.c Deb ...	120—125	...	...
357,900	"	Aug. 28	7½	7½	Brighton, &c., 6 p.c. Con ...	163—168	...	...
540,000	"	"	6⅔	6⅔	Do. 5 p.c. Con. ...	150—155	...	152½—154
195,500	"	"	6	6	Do. 6 p.c. B. Pref.	136—141	...	...
1,487,500	"	July 24	5	5	Bristol 5 p.c. max.	114—116*a*	+½	...
120,420	"	Dec. 18	4	4	Do 1st 4 p.c. Deb. ...	100—102*a*	...	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	100—102*a*	...	...
328,790	"	"	5	5	Do. 5 p.c. Deb.	119—121*a*	...	...
855,000	"	Sept. 25	8	7	British Ord.	155—160	...	157—158½
100,000	"	Dec. 18	7	7	Do. 7 p.c. Pref.	151—156	+6	155
350,000	"	"	5½	5½	Do. 5½ p.c. Pref.	106—111	...	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	109—109½
160,000	"	Jan. 8	5	5	Cambridge 5 p.c. Deb.	113—118*	...	...
100,000	10	May 22	6	4	Cape Town, Ltd.	5⅛—6⅛	−1⅛	5⅛
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	6½—7½	...	...
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb. ...	95—100	...	97—99¾
626,860	"	July 24	6	6	Cardiff Con. Ord.	123—128	...	...
237,860	"	Jan. 8	5	5	Do. 5 p.c. Red. Deb.	103—108*	...	...
157,150	"	Aug. 14	6½	5	Chester 5 p.c. Ord.	115—125*b*	...	...
98,936	1	Oct. 9	2/-	2/-	Colombo, Ltd. Ord.	1⅞—1⅞	...	...
24,500	1	"	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	19/-—21/-	...	...
609,204	1	Oct. 9	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	1⅛—1⅛	...	20/4½
296,053	1	"	1/8'30	1/8'30	Do. 8 p.c. Pref.	23/-—25/-	...	24/3
1,775,005	Stk.	July 24	6½	5	Commercial Ord.	122—127	...	125
475,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	74—79	...	...
286,344	"	Mar. 6	—	5	Do. 5 p.c. Deb. ...	121—126	...	...
807,560	"	Aug. 14	7	7	Croydon sliding scale ...	150—155	...	154—155
469,590	"	"	5	5	Do. max. div.	105—110	...	108¾—109½
500,000	"	Jan. 8	5	5	Do. 5 p.c. Deb.... ...	120—125*	...	121
542,270	"	Mar. 6	7	10	Derby Con.	170—180*c*	...	...
55,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	98—100*c**	...	...
209,000	"	Aug. 28	5	5	East Hull Ord. 5 p.c. ...	108—113	...	110
179,500	"	Aug. 28	6	6	East Surrey Ord. 5 p.c. ...	128—133	...	130½—132½
155,019	"	Dec. 18	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
1,002,180	"	Sept. 25	17	15	European, Ltd.	130—135	...	131½—133½
19,342,763	"	Aug. 14	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	26/9—27/9*f*	...	26/9—27/3
2,600,000	"	"	3⅜	3⅜	Do. 3⅜ p.c. max.	87—90	...	87½—88½
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref. ...	103—106	+1	104—105½
6,102,497	"	Dec. 18	3	3	Do. 3 p.c. Con. Deb. ...	82—85	+1	82½—84½
3,642,770	"	"	5	5	Do. 5 p.c. Red. Deb. ...	114—117	...	117
3,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	113—116	...	114—115½
270,466	"	Aug. 28	6	6	Harrogate New Cons. ...	120—125	...	...
82,500	"	Aug. 28	7	7	Hastings & St. L. 5 p.c. Conv.	149—154	...	...
258,740	"	"	5½	5½	Do. 3½ p.c. Conv.	117—122	...	119
140,000	1	Oct. 9	1/0	1/0	Hongkong & China, Ltd. ...	29/-—32/-	...	29/-
218,200	Stk.	Aug. 14	6	6	Hornsey Con. 3½ p.c. ...	130—135	+10	...
5,600,000	"	Nov. 6	14	10	Imperial Continental Cap.	218—223	...	218—221
223,130	"	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	90—95	...	92½—93½
235,242	"	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord. ...	170—175	...	...
2,145,907	"	Aug. 14	6	6	Liverpool 5 p.c. Ord. ...	130—132*b*	...	...
245,500	"	Dec. 18	5	5	Do 5 p.c. Red. Pref. ...	101—111*b*	...	...
306,083	"	July 17	4	4	Do. 4 p.c. Deb. ...	99½—101½*b*	...	...
165,736	"	Aug. 28	10	8	Maidstone 5 p.c. Cap. ...	180—190	...	...
56,176	"	Jan. 8	3	3	Do. 3 p.c. Deb. ...	70 75*	+2	73
75,000	5	Dec. 4	†10	†10	Malta & Mediterranean ...	9—11	...	10—10½
392,000	—	Oct. 2	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb. ...	98—103	...	...
231,978	Stk.	Aug. 28	5	5	M. S. Utility "C." Cons. ...	111—116	...	...
818,657	"	"	4		Do. 4 p.c. Cons. Pref.	95—100	+3	96—97½
112,126	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	100—106*	...	103½
148,955	"	"	5	5	Do. 5 p.c. Deb. ...	117—122*	...	...
675,000	"	31 May '31	†6	†6	Montevideo, Ltd.	55—65	+5	54—57
2,061,315	"	Aug. 14	6‡	6	Newcastle & Gateshead Con.	25/9—26/9*d*	+/3	...
682,856	"	"	4	4	Do. 4 p.c. Pref. ...	101—103*d*	...	...
776,706	"	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	90½—91½*	...	...
277,285	"	Nov. 6	5	5	Do. 5 p.c. Deb. '43 ...	105—107*d*	...	...
274,000	"	Aug. 14	5	5	Newport (Mon.) 5 p.c. max.	101—104*a*	...	...
204,940	"	Aug. 28	7½	7½	North Middlesex 6 p.c. Con.	163—168	...	...
396,160	"	Aug. 14	5	5	Northampton 5 p.c. max. ...	101—106	...	...
300,000	"	Dec. 4	7	10	Oriental, Ltd.	147—152	...	...
316,617	"	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	165—170	+1	166½
504,416	"	Aug. 28	8	8	Portsm'th Con. Stk. 4 p.c. Std	165—170	+3	...
241,446	"	"	5	5	Do. 5 p.c. max. ...	102—107	...	...
114,000	"	Aug. 14	5	5	Preston 5 p.c. Pref. ...	105—110	...	...
686,312	"	July 24	4	4	Primitiva 4 p.c. Rd. Db. 1911	88—93	...	...
389,813	"	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	98—93	...	...
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref. ...	6¾—7¾	...	...
1,736,968	Stk.	Sept. 11	6	6	Sheffield Cons.	134—136*e*	...	...
95,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	90—91*e**	...	...
138,201	"	Sept. 11	5	5½	Shrewsbury 5 p.c. Ord. ...	137—142	...	139½
90,000	10	June 12	15	14	South African	3—5	...	...
6,709,895	Stk.	Aug. 14	7	5	South Met. Ord.	135—138	+1	135½—137
1,135,812	"	"	6	6	Do. 6 p.c. Irred. Pf.	137—142	...	140½—142
850,000	"	"	20/-*g*	4	Do. 4 p.c. Irred. Pf.	102—105	...	...
1,895,445	"	Jan. 8	3	3	Do. 3 p.c. Deb. ...	79—82*	...	81½—82
1 000,000	"	July 24	5	5	Do. 5 p.c. Red. Deb.	112—116	...	114—115
209,820	"	Aug. 14	8½	8½	South Shields Con. ...	170—171*d*	...	...
1,543,795	"	Aug. 14	6	6	South Suburban Ord. 5 p.c.	131—136	...	132—136
300,000	"	"	5	5	Do. 5 p.c. Pref.	114—119	...	118
300,000	"	"	—	4	Do. 4 p.c. Pref.	100—103	...	103½
868,837	"	Dec. 18	5	5	Do. 5 p.c Deb.	120—125	...	122½—123½
100,000	"	"	4	4	Do. 4 p.c. Deb.	100—103	...	...
647,740	"	Aug. 28	5	5	Southampt'n Ord. 5 p.c. max.	110—115	...	115
121,275	"	Dec. 18	4	4	Do. 4 p.c. Deb.	97—102	...	...
350,000	"	Aug. 28	5½	5½	Swansea 5½ p.c. Red. Pref.	107—111	...	109½
200,000	"	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	103—108	...	...
1,076,490	"	Aug. 14	6⅔	6⅔	Tottenham and District Ord.	150—155	+1	151½—153
300,000	"	"	£5	5½	Do. 5½ p.c. Pref. ...	125—130	...	...
62,235	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
199,005	"	Dec. 18	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
85,701	"	Oct. 9	6	6	Tuscan, Ltd. 6 p.c. Red. Db.	90—100	...	...
347,769	"	Aug. 28	7	7	Uxbridge, &c., 5 p.c. ...	146—151	...	...
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
1,322,220	"	July 10	7	7	Wandsworth Consolidated	154—159	...	157½—159
1,096,373	"	"	5	5	Do. 5 p.c. Pref.	118—123	...	121½—122½
1,317,964	"	Dec. 18	5	5	Do. 5 p.c. Deb.	118—123	...	122½
158,400	"	Aug. 28	6A	5	Winchester W. & G. 5 p.c. Con.	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock *g.*—For quarter. *h.*—Paid £3, including 10s. on account of back dividends. ‡—The interest due 1/7/33 was paid on that date. * Ex. div. † Paid free of income-tax. ‡ For year. Hongkong & China, Ltd.—paid on £10 shares.

STOCK FOR SALE BY TENDER.

By Order of the Directors.

KNOTTINGLEY GAS COMPANY.

Messrs. A. & W. RICHARDS

are Instructed to OFFER FOR SALE BY TENDER

6000 £1

FIVE PER CENT. PREFERENCE SHARES.

Minimum Price of Issue, £1 per Share.

Prospectus and Form of Tender (which latter must be sent in by 11 o'clock on Tuesday, 6th February) may be obtained of A. & W. RICHARDS, 37, WALBROOK, E.C. 4.

COMPANY NOTICES.

THE GAS LIGHT AND COKE COMPANY.

NOTICE is Hereby Given that an ORDINARY GENERAL MEETING of the Proprietors of the Gas Light and Coke Company will be held at the Chief Office of the Company, Horseferry Road, Westminster, S.W. 1, on Friday, the 9th day of February next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the Declaration of a Dividend for the Half-Year ending on the 31st day of December last, and to Elect Directors and Auditors in the place of those who will at such Meeting go out of Office in compliance with the Company's Acts or Schemes of Amalgamation.

By order,
WILLIAM LYLE GALBRAITH,
Secretary.

Chief Office:
Horseferry Road,
Westminster, S.W. 1,
Jan. 22, 1934.

SOUTH SUBURBAN GAS COMPANY.

NOTICE is Hereby Given that the ANNUAL ORDINARY MEETING of the Proprietors of this Company will be held at the Hotel Metropole, Northumberland Avenue, W.C. 2 (Whitehall Place entrance), on Friday, the 9th day of February, 1934, at Twelve o'clock noon precisely, for the following purposes:

To receive the Report of the Directors and Statement of Accounts for the Year ended 31st December last.

To declare Dividends for the Half-Year ended the same date.

To elect two Directors and one Auditor in the place of those retiring by rotation.

For general purposes.

Dated this 22nd day of January, 1934.

By order of the Board,
T. BROWN,
Secretary.

CAST IRON PIPES

FOR

GAS, WATER, & STEAM

1¼in. to 12in. BORE.

THOS. ALLAN & SONS, LTD.,

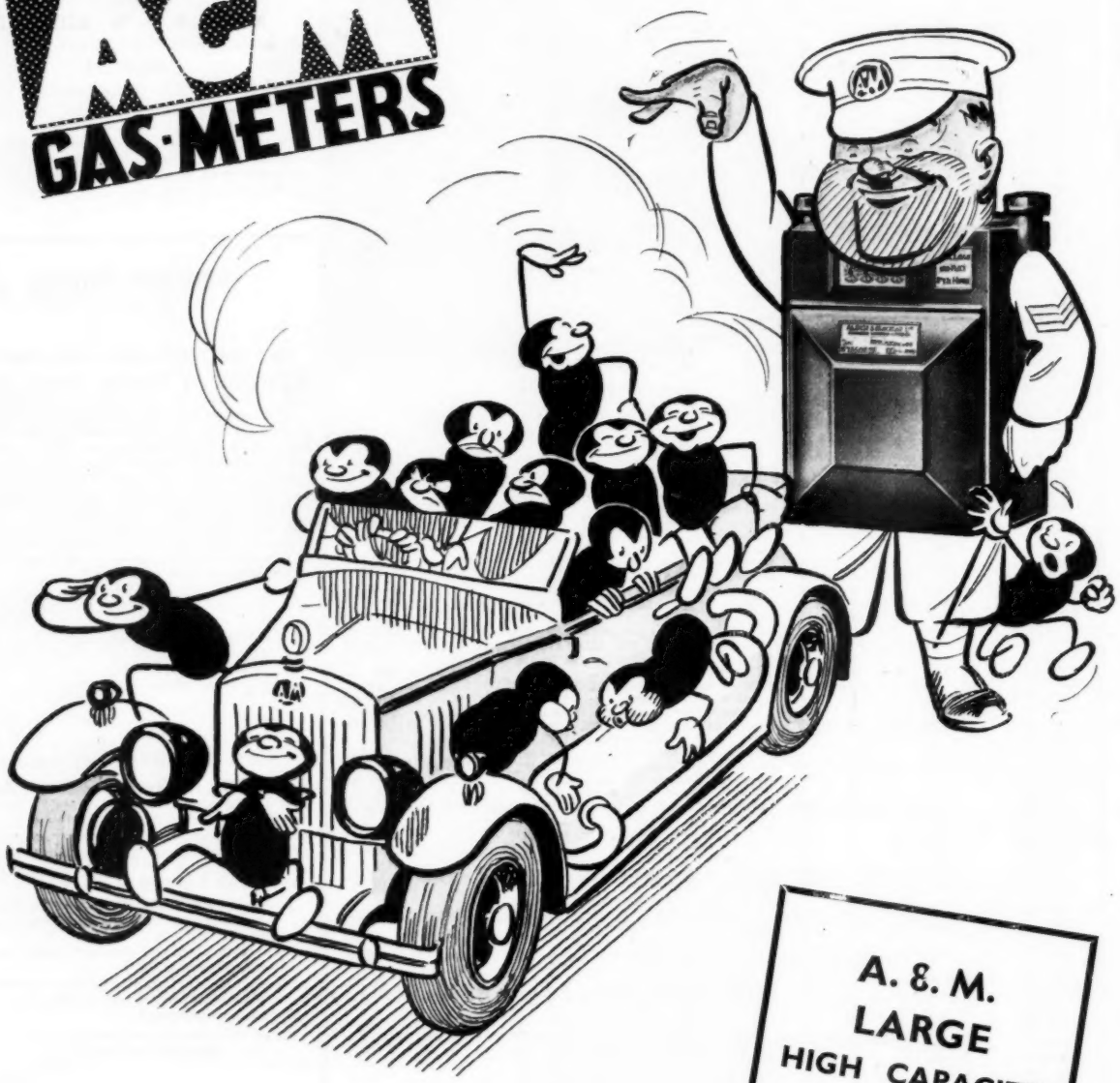
Bonlea Foundry,

THORNABY-ON-TEES.

Telegrams: "BONLEA, THORNABY-ON-TEES."
Telephone No.: STOCKTON 66121 (Two lines).

A&M GAS-METERS

TRAIN·THE·THERMS



BOTTLED THERMS

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